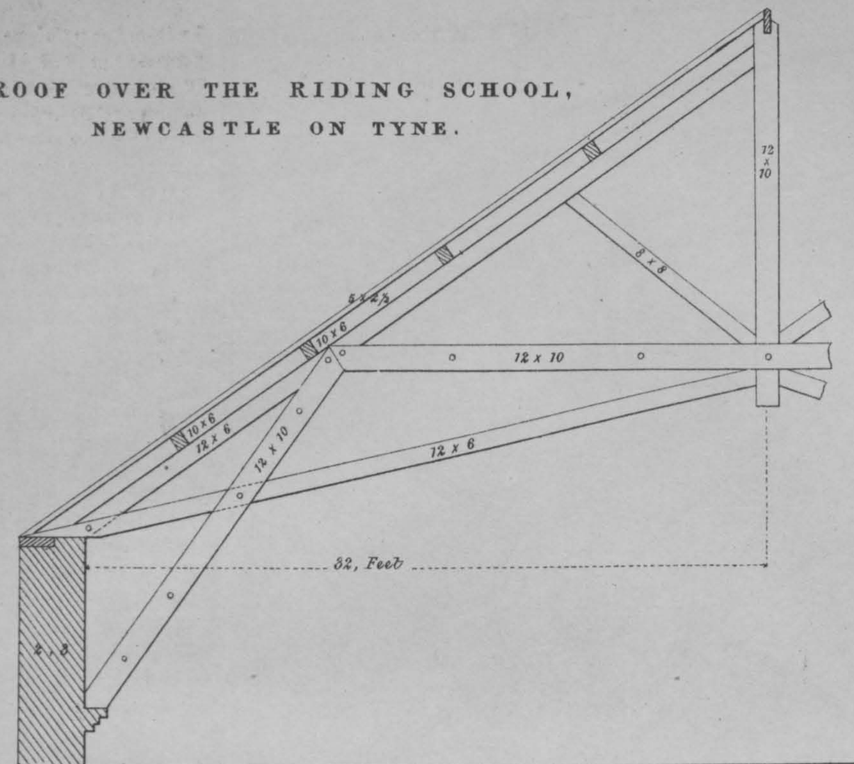
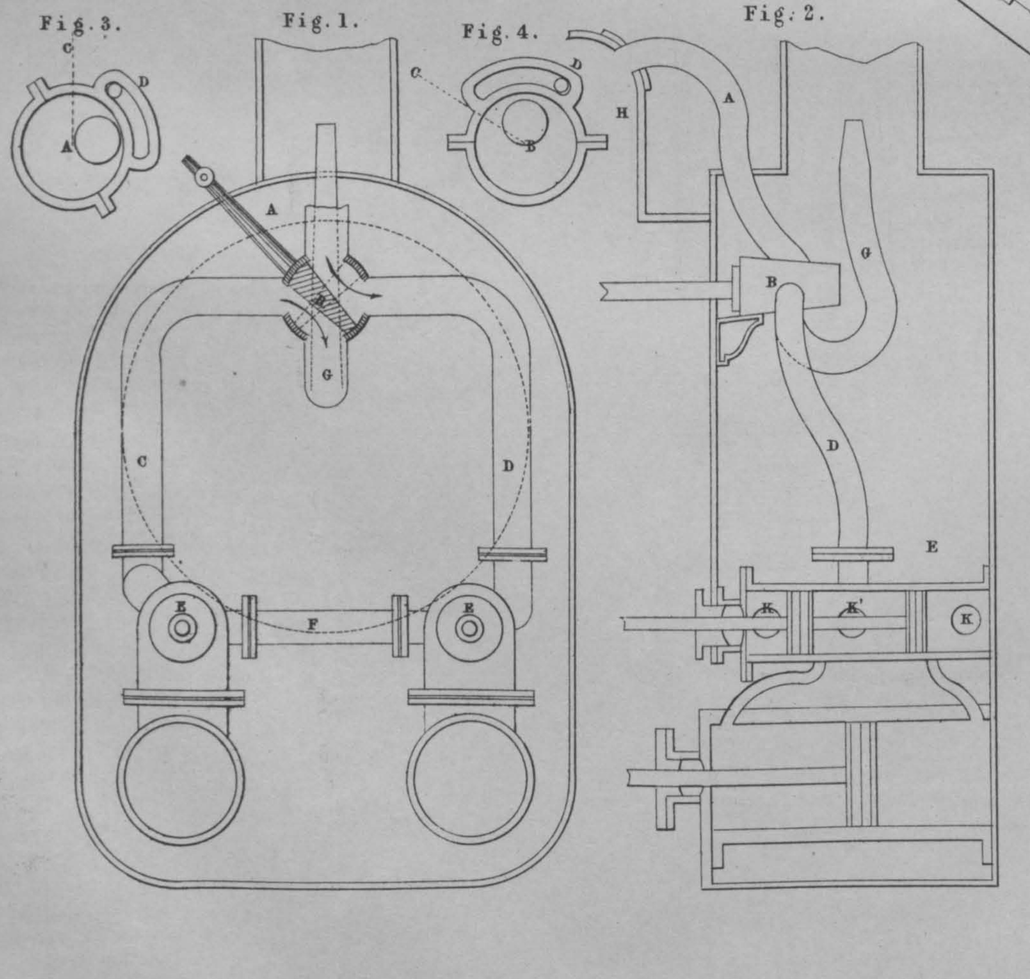
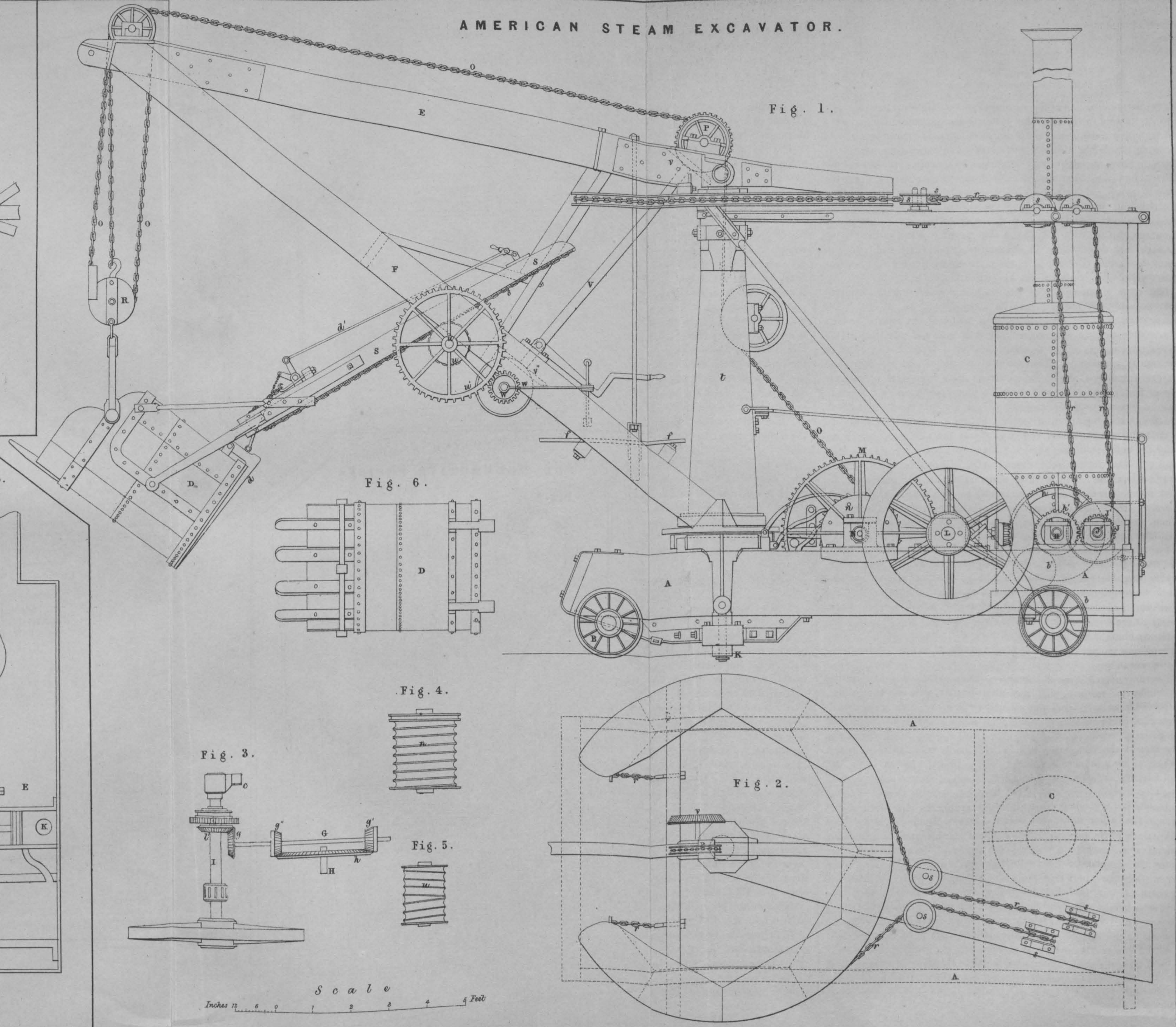
ROOF OVER THE RIDING SCHOOL, NEWCASTLE ON TYNE.



REVERSING APPARATUS FOR LOCOMOTIVE ENGINES.



AMERICAN STEAM EXCAVATOR.



THE AMERICAN STEAM EXCAVATING MACHINE. ("YANKEE GEOLOGIST.")

(With an Engraving, Plate VI.)

This machine, which is the invention of the late Mr. Ottis, of New York, is an application of steam power to the purposes of excavation and dredging; and for the former purpose, appears greatly superior to any thing which has hitherto been achieved in excavating machinery. The accompanying engraving, which has been made expressly for our *Journal*, by Mr. George Spencer, Mechanical Draughtsman, from the original working drawings in his possession, presents the principal side elevation (Fig. 1) of the machine, which brings all the working parts sufficiently into view; Fig. 2, a plan of the horse-shoe pulley and crane top; the dotted lines show the position of the lower framing or stage and boiler; Fig. 3, shows the crank shaft and gearing; Fig. 4, the main drum; Fig. 5, the main drum for working the excavator; and Fig. 6, a plan of the excavator.

The whole of the details of this machine, which are very elaborate and complete, of course cannot be attempted in an article of this nature; we will, however, describe as much of the details and its principal feature as are necessary to a proper understanding of the several movements of the machine, and then describe each of those movements separately. The machine consists of a strong horizontal wooden framing or stage A, mounted upon two pairs of railway wheels B, for locomotion, which run on temporary rails, laid down as may be required; on the one end of the stage is fixed a cylindrical boiler C, and the gearing for turning the crane round. In the middle is placed the gearing for working one of the motions of the excavator D; and, at the other end is placed the wooden crane E, in form similar to an ordinary timber crane, on the diagonal brace of which is placed a platform *f*, on which an assistant stands; and gearing U, for working another motion of the excavator D. To support the machine laterally, strong brackets or arms project on either side, the ends of which are furnished with screws to adjust the machine to the inequalities of the surface of the ground.

The excavator or shovel D, (Figs. 1 and 6,) is formed of stout boiler plate, and is firmly rivetted together; it is of a box shape, having one end open; on the lower edge are four tangs or points, which serve to penetrate and loosen the soil; the other end is hung on swivel hinges, and fastened by a spring *d*, which may be set at liberty by means of the lever and rods *a*, Fig. 1.

The machine is made to perform three distinct movements; 1st, the digging movement; 2nd, the turning movement, and 3rd, the locomotive movvement.

The Digging Movement consists of two motions, one for drawing the excavator forward, and the other for driving it into the ground, both of which is done simultaneously; the first motion is performed in the following manner. On the horizontal stage A, and in front of the boiler C, is placed a small high-pressure engine, (not shown in the engraving,) the connecting rod of which acts upon the crank *c*, and gives a rotary motion to the shaft L, and with it the pinion *l*, (Fig. 3,) which works into the large wheel M, mounted on the shaft N, upon which is fixed a large channelled barrel or drum *n*, (Figs. 1 and 4,) round which the hauling chain O, is coiled; this chain passes upwards through the hollow crane post, over the indented pulley P, to a double pulley fixed at the jib head, thence round the blocks R, to which the excavator is suspended, as the chain wound up draws the excavator out of the ground both in a forward and upward direction, when driven into the ground by the second motion. This last motion is communicated by the chain traversing over the indented pulley P, to another gearing. On the axle of the indented pulley P, is fixed a bevelled wheel *v*, (Fig. 2,) which works into a similar one *v'*, (Fig. 1,) mounted on to the upper end of the oblique shaft V, on the lower end of which is a corresponding bevelled wheel *v''*, working into another *w*, fixed upon the shaft W; upon this shaft is a pinion *w'*, which takes into the large spur wheel *u'*, mounted upon the shaft U, upon which is a channelled drum *u*, round which is coiled the chain *s*, attached to the diagonal wooden arms S; on the lower end of these arms is fixed an iron yoke, to which is suspended on pivots the excavator. By this arrangement, as the main chain O, passes over the pulley P, motion is communicated to the shaft U, for the purpose of forcing downwards in a diagonal direction the arms S, and with them the excavator into the ground. A man stands upon the stage *f*, for throwing in and out of gear this apparatus, and to regulate the motion for lowering or raising the excavator.

The next motion to be described, is for the purpose of turning the crane round either to the right or to the left; this is effected by another gearing in the following manner. On the first crank shaft L, is fixed a bevelled wheel *l'*, (Fig. 3,) which works into a similar wheel *g*, mounted on to the end of a horizontal shaft G, upon which are placed loose two bevelled wheels *g' g''*, either of which can be thrown in or our of gear so as to work, as may be required, into the large bevelled wheel *h*, mounted upon the shaft H; upon this shaft is a pinion *h'*, which works into the wheel *j*, fixed on the shaft J, upon this shaft is fixed an indented pulley *j'*, round which the chain *r*, is coiled, and passes upwards over pulleys *s*, round either side of the horse shoe pulley, to the ends of which it is fixed by iron bolts; the horse shoe pulley is fixed by means of strong iron stays to the crane, and when it is made to revolve the crane jib is turned round on the stationary post *t*, either to the right or to the left as may be required, and empties the contents of the excavator into a wagon or barrow.

The Progressing Motion is effected by placing on the hind wheel axle a strong wheel, shown by a dotted circle *b*, (Fig. 1,) which communicates with a pinion *b'*, on the shaft *i*, by an intermediate pinion *b''*, as shown by a dotted circle; motion being given to the shaft H, by the bevel gearing, described in the last motion, a forward or backward motion of the machine is obtained.

We have no precise data as to the cost of the machine or the quantity of work that can be performed by it, further than a short paragraph we gave in the last November number of the *Journal*, wherein it states that the machine is capable of digging 1000 cubic yards of earth *per day*, and that a machine complete costs about 6000 dollars in America.

ROOF OF THE RIDING SCHOOL AT NEWCASTLE-ON-TYNE.

(With an Engraving; see Plate VI.)

Sir—Having expressed your intention of giving some examples of construction useful to the student, in the description of the roof of the Polytechnic Institution, Vienna, in a former number of your excellent work, I am induced to send you the enclosed sketch, on account of the similarity of construction in the two, and they being the only cases I know extant where support is obtained from the side walls of the building on a line lower than the level of the tie beam, I shall first describe the peculiarities of the Vienna roof, and then of the roof at Newcastle. The former is 56 ft. span, and formed of curvilinear ribs 12 in. square, standing on a set-off of the wall considerably below the wall plate, and the crown of the rib rising about as much again above it, the slope or pitch of the roof being made uniform with rafters of smaller scantling. The ribs are cut out to the sweep of the curve, and are not laminar ribs, by which mode much additional stiffness is acquired. It is evident the arch is the principle of construction. The covering is copper, the weight being about 100 lb. per square, whilst tiles are 650 lb. weight per square. The annexed engraving exhibits the roof constructed over the circus or riding school at Newcastle, erected in 1789, under the superintendence of Mr. David Stephenson, architect, who was a resident and practised in Newcastle; he was the architect of the Theatre Royal and All Saints' Church, and architect to His Grace the Duke of Northumberland, &c. The span of the roof is 64 feet in clear of the walls, the length about 76 ft., and the height of the room from the floor to the crown of the arch, or horizonal beam at the foot of king post, 30 ft. The tie beams and principals are 12 ft. by 6 ft. placed 10½ ft. apart. The struts from king post 8 ft. by 8 ft.

The king post, straining collar (the horizontal beam) and struts from side walls, 12ft. by 10ft. in two thicknesses and bolted together. The purlins are 10ft. by 6ft. and about 9ft. apart, being four in number on each side of the span. The common rafters are 5ft. by 2 in. and are placed 3ft. apart from centre to centre. The ridge 12in. by 2 in.

By a comparison of the two roofs, the simplicity of the Newcastle roof over that with curved ribs, is at once apparent; no wall plates are used at the foot of the struts on the side walls, and at the level of the eaves; a pole plate and vertical posts at the foot of each rafter is dispensed with. The braces are prolonged to the king post, and act both as a tie beam and a counter strut to the main struts or portion of the curb roof, resting on the side walls at a level lower than the eaves. The principle of this roof is that of the common curb roof, as by inspection of the sketch it will be seen that the strongest scantlings are so arranged. On a few of the couples or pairs of principals a curved rib is affixed to the tie beam and strut, so as to give the roof a curvilinear form; but as it is dispensed with in some, it shows that it is not essential to the stability of the structure.

I am, Sir,

St. Ann's, Newcastle-on-Tyne. Your obedient servant,

O. T.

ON REVERSING LOCOMOTIVE ENGINES.

(With an Engraving, see Plate VI.)

SIR—Having by chance fallen in with a number of your *Journal*, (the number for February, 1842,) I perceive in it a design for reversing locomotive engines, signed H. and P., upon which, with your permission, I beg to make a few remarks, as the principle of it is similar to one of my own.

In the latter part of the year 1842, I designed two plans for reversing, the reversing valve being in the one case a slide, and in the other a four way cock; the former of these was published in a contemporary journal,[1] but having been forestalled in my design for the latter, it was never published: the two grand objections to be contended against in these designs, were, the pressure of the steam against the under side of the slide when reversed, and the (as yet) impossibility of obtaining *double lead*; to obviate the former of these, I proposed the design enclosed, which is much more simple and less complex than H. and P.'s plan. In the first place, the use of the four way cock for changing the direction of the steam, does away with the necessity of filling up the smoke box with the piston valve, and is besides, less expensive; secondly, the connexions between the pistons in the *working* valve box, are mere rods, instead of the pipes used by H. and P.; thirdly, a less quantity of steam pipes are required, as instead of *two* sets of pipes between the reversing and working valves, I use three short pipes crossing the bottom of the smoke box, connecting the *centre* of each box, and the *ends* individually.

For explanation of my design, allow me to refer you to the sketches enclosed.—See plate VI.

A, is the steam pipe, which conveys the steam from the top of the dome H, through the top of the smoke box, to the four way cock B, from whence the pipes C and D, take it to the valve boxes, the pipe C, connects the cock with the *ends* of each valve box, or that part on the *outside* of the working pistons in it, and the pipe D, connects it with the centres of each box or that part of the box *between* the pistons, in Fig. 1; the four way cock (shown in section) is so set as to allow the steam to proceed along the pipe D, to the *centres* of the valve boxes, while the waste escapes up the pipe C, from the *ends* of them, into the blast pipe; there are three pipes between the valve boxes E E, one of which is shown at F; the section of the valve box in Fig. 2, shows the positions of these pipes, which enter the box at K, K, K', the pipe D, being connected to the box opposite K', and thence proceeding across to the other box, and the pipe C, being connected opposite to the passages K K, and thence crossing to the box on this side; the mode of action of the valve is so simple, as not to require any explanation further than that the pressure is balanced as effectually, as in H. and P.'s plan; the dotted lines show the position of the four way cock plug when reversed. Having, as I hope, fully described by own plan, will you allow me to say a few words respecting H. and P.'s mode of obtaining *double lead*, may I ask them if this plan has ever been tried, and if so, if it was found to answer the inventors' expectations, as it is my firm belief, that if it had been tried before its appearance in your pages, it never would have made that appearance. The mode of working two valves with one eccentric, is an exceedingly ingenious one, and as far as I am aware, is quite an original idea; but it will not require much demonstration to show the futility of the mode of obtaining lead, by the use of the circular slots; the mistake into which H. and P. seem to have fallen, is by no means a solitary instance of premature conclusions, as witness the propositions contained in the 3rd and 4th Vols. London *Mechanic's Magazine*. I will take the same position of the eccentric, as given by H. and P., thus in Fig. 3, let the perpendicular dotted line represent the position of the crank, being at half stroke, then (lead being given) the position of the pin on the lever for working the valve, will be at D; but suppose the steam passages to be reversed, the crank, carrying with it the eccentric ring, will revolve in a contrary direction, and the pin D, will not be moved until the crank arrives at C, as shown in Fig. 4, consequently the valve will be just so much in arrear as it had lead in the former position, as the valve lever will not be in the proper position for giving lead until the crank arrives at C, whereas it ought to be in the same position as in Fig. 3, which is at half stroke. It is not, perhaps, generally understood, that the real position of the valve to obtain lead requires *no alteration*, when reversed in this manner, but the relative position of the valve to the motion of the eccentric must be altered.

I am, yours, obediently,

42, Great Avenham Street, Preston, WILLIAM JOHNSON.

April 7, 1843.

[1] The Practical Mechanic and Engineer's Magazine.

VELOCITY OF WATER DOWN VERTICAL PIPES.

SIR—I have attentively perused the several articles which have lately appeared in your scientific *Journal*, on the velocity of water down vertical pipes under certain conditions; but I by no means agree with your correspondent T. F. . . . n, who asserts, that the velocity of water down a vertical pipe 16 feet long, under these conditions, will be 32 feet per second. Nor does it appear to me, that the mutual cohesion between the several layers or particles of water in the pipe, is a force sufficient of itself, to account for the solidity of the issuing stream, as stated in a late number of your *Journal*.—The following is my humble opinion on this interesting subject.—

First, as to the *velocity* of water down a vertical pipe 16 feet long the top of the pipe being considered to be always covered with water.—

The following table extracted from "Grier's Mechanic's Dictionary," exhibits the natural velocity due to a body, after having fallen through the undermentioned distances; and will be found useful as a reference in the following remarks.—

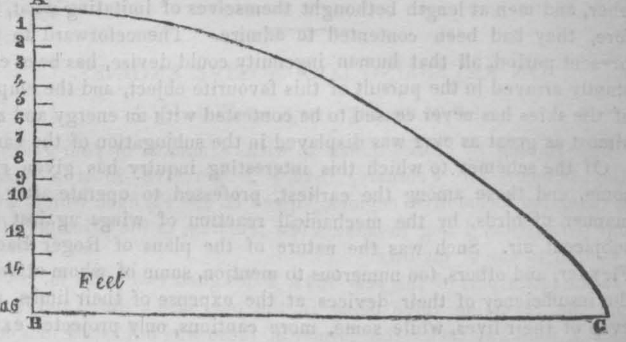
Space through which the body falls in feet.	Velocity acquired at the end of the time. feet per second.	Space through which the body falls in feet.	Velocity acquired at the end of the time. feet per second.
1	7·3103	10	24·7647
2	11·0637	11	25·9628
3	13·4165	12	27·1232
4	15·6562	13	28·2264
5	17·2903	14	29·9786
6	19·1725	15	30·3601
7	20·7078	16	31·3176
8	32·1435	17	32·2833
9	23·4890	18	33·1975

It appears from this table, which is founded on the well-known law, that "the velocity acquired by a body falling from rest in a free space, is as the square root of the space fallen through," that the velocity of water at the end of the 1st ft. is 7·3103 ft. per second, (and not 4 ft. as stated by your correspondent T. F....n); at the end of the 4th ft. it is 15·6562: and at the 16th ft. 31·3176 ft. per second: or, in round numbers, 8, 16, and 32 ft. per second. If then the motion of the whole of this column is uniform, whence has the power been obtained to increase the velocity of water at the end of the first foot, from 8 feet per second, to, say, 16 or 32 feet per second? Doubtless from the superior velocity due to the lower parts of the water in the pipe. If this is the case, then must the natural velocity due to the lower portions of the water be diminished; for nobody when in motion can impart any motion to another body at rest, or increase the velocity of that body if in motion, without a diminution of its own velocity, in proportion to the respective momenta of the two bodies.—Therefore, it is not possible that the water at the end of the 16 feet pipe, whose natural velocity is 32 feet per second, can, after it has imparted a quicker motion to the higher portions of water, still possess the same velocity that it would have had, if it had not parted with a portion of that velocity, in increasing the velocity of the upper parts of this column. Consequently, it follows, that the velocity of the water issuing from the pipe must, (if the stream fills the pipe and flows uniformly through it), be diminished, and therefore be less than 32 feet per second.

Next, as to the cause of the *solidity* of the issuing stream.—Let us first consider the phenomena of a stream of any liquids falling from a height, but not down the interior of a pipe; or even a continuous stream of leaden bullets. For a short distance we perceive the stream solid, till the increased velocity of the lower parts as they descend causes them to leave those immediately above them, air filling up the intervening space, and thus the solidity of the stream is broken. Now let us turn to the pipe, and we see, by the above table, that the natural velocity of a layer of water which has fallen one foot, is 7·3103 feet per second, and of another which has fallen two feet, 11·0637 feet per second; why then does not this lower portion fall faster than the higher one, and separate from it, and thus break the solidity of the stream? Simply because if it did so, there would be a vacuum between these two portions of water, bacause the sides of the pipe are impervious to the air; and as the atmosphere is pressing on the water at the top and bottom of the pipe with a pressure, say, of 14 pounds per square inch, these portions are kept together by this pressure; for no sooner does an under stratum of water try, as it were, to leave the stratum above it, and form a vacuum, than the presure of the atmosphere at the top of the pipe is brought into action, and the velocity of the upper stratum increased; while at the same time a portion of the atmospheric pressure, being by the same tendency removed from the upper surface of the lower stratum, the full pressure of the atmosphere is exerted upwards at the base, and the velocity of this lower stratum is consequently diminished. This certainly appears to account more satisfactorily for the solidity of the stream, than the force of cohesion; for this force must have the same influence over the particles of water whether they are in the inside or on the outside of the pipe.—As a proof, that when water is descending in the interior of a pipe, which is continually covered with water on the top, the atmosphere has a tendency to rush in through the sides. I need only mention the wellknown fact, that if in a pipe under these circumstances there happen to be a crack, or a hole bored through the sides, the air immediately rushes in, and the solidity of the stream is destroyed.

Lastly, to determine the *actual velocity* of this continuous column of water.—Let us suppose the water in the pipe composed of an immense number of laminæ, each of the thickness of a particle or atom of water, and consequently of the same thickness and weight; and let us take under our consideration the case of any two of these contiguous laminæ, and suppose that the velocity due to the higher one is, say, one inch per second; and the velocity due to the lower one is, say, two inches per second. Then if these two laminæ, when moving with these velocities, be at the same instant connected by the pressure of the atmosphere, or otherwise, so that the one cannot move on without the others moving along with it, it is evident, since the quantity of matter in each is the same, that the resultant velocity of the two will be one half of the sum of their original velocities, or one and a half inches per second. If then we could obtain the natural velocities due to each respective laminæ, the average would be the result and velocity for the whole column. On taking the average of initial and final velocities due to the water at the end of each successive two feet, from the foregoing table, and then dividing their sum by 8, we have 20·6077 feet as the average velocity of the whole column. And if by approximating rather more closely to the system of atomic laminæ, we take the average of the initial and final velocities due to each *foot* of water, and divide the sum by 16, the resultant is 20·7265 feet per second.

Again, since "The velocity acquired by a body falling from rest in free space is as the square-root of the space fallen through," the space varies as the square of the velocity.—If then, we take the spaces fallen through at the termination of each foot in the 16 feet, (as in the first column of the above table) as abscissa, and the respective velocities (as in the second column) as ordinates, the resultant curve will be a parabola similar to the figure below.—



Let us suppose the line AB, represented in this figure 16 feet, or the space fallen through, to be divided into an almost infinite number of parts equal to the number of atomic laminæ in the column of water; then if we could find the length of the several ordinates at those points, and divide the length of the whole by their sum, the result would be the average length of all the ordinates, and consequently the average velocity. This can be done by finding a rectangle whose area is equal to the area of the parabola, and one of whose sides is equal to AB.—Now, $\frac{2}{3} \times$ abscissa AB $\times$ ordinate BC $=$ area of the parabola $= \frac{2}{3} \times 16 \times 31{\cdot}3176 = 334{\cdot}0544$ ft. Therefore $\frac{334{\cdot}0544}{16} = \frac{\frac{2}{3} \times 16 \times 31{\cdot}3176}{16} = 20{\cdot}8784$; consequently the two sides of this rectangle are 16 feet and 20·8784 feet, of which 16 feet represents the space fallen through and 20·8784 feet the average of all the ordinates, and consequently the average velocity. 20·8784 feet therefore is the average of the natural velocities due to the several atomic laminæ composing this column of water. Again, it is evident, that since the abscissa AB (or 16 feet), enters both into the numerator and denominator of the fraction representing the average velocity, it may be eliminated altogether; and the expression then becomes $\frac{2}{3} \times 31{\cdot}3176$; or, "The velocity of water descending the interior of a pipe 16 feet long, is equal to $\frac{2}{3}$ of the natural velocity due to a body, after it has fallen through a distance, in free space, equal to the length of the pipe."

I. T——N.

Shropshire Lunatic Asylum.—We understand Messrs. Cooper, builders, of this town, have entered into contract with the magistrates of the county of Salop, for the erection of a Lunatic Asylum for that county. The building is from a design by Messrs. Scott and Moffatt, of London, in the Elizabethan style. The extent of the front 280 feet, and arching 170 feet. The plan is in the shape of the letter H. The first part of the building will cost £11,000.—*Derby Reporter.*

THE AERIAL TRANSIT MACHINE.

Analysis of the projected Aerial Transit Machine, and of the principles involved in its construction and employment.

From the earliest period of antiquity the desire to navigate the skies has ever formed one of the most prominent passions of the human breast. In the commencement, ere man had acquired sufficient skill to be able to submit his ideas to the test of experiment, the indulgence of this passion could only display itself in vain aspirations or the wild effusions of an unrestrained and romantic imagination. To this source may be traced some of the most elaborate conceptions of the Heathen poets; the fables of Dædalus and Icarus, of Perseus and Bellerophon, the air-borne car of Medea, the winged heel of Mercury, the Harpy, Chimæra, Pegasus, and many others equally fanciful and absurd, which characterise the history and mythology of the remoter ages.

As the world, however, advanced, and some insight began to be obtained into the nature and constitution of the surrounding atmosphere, the reveries of the poet gradually gave way to those of the philosopher, and men at length bethought themselves of imitating what, before, they had been contented to admire. Thenceforward to the present period, all that human ingenuity could devise, has been constantly arrayed in the pursuit of this favourite object, and the empire of the skies has never ceased to be contested with an energy and zeal almost as great as ever was displayed in the subjugation of the earth.

Of the schemes to which this interesting inquiry has given rise, some, and those among the earliest, professed to operate after the manner of birds, by the mechanical reaction of wings against the subjacent air. Such was the nature of the plans of Roger Bacon, Fleyder, and others, too numerous to mention, some of whom attested the insufficiency of their devices at the expense of their limbs, and even of their lives, while some, more cautious, only projected experiments, which they left to others to perform.

To schemes of this description, which may be termed the *mechanical*, succeeded others based upon the physical or chemical principles of the atmosphere, real or presumed. Of this nature were the designs of Bishop Wilkins, and the Jesuit Lana, and that (more absurd than either) which, proceeding upon the supposition that the particles constituting the upper strata of the ætherial mass were of a more buoyant consistency than those below them, proposed to accomplish its object by enclosing in a proper vessel a portion of air abstracted from the very regions which itself was to offer the only means of approaching.

It would occupy more space than we could here afford, and serve moreover no beneficial purpose, were we to attempt to recount, much less to describe, all the schemes that have been successively proposed, dilated upon, tried, found wanting, and subsequently abandoned, in the prosecution of this interesting design. Suffice it to say that in the one material point, namely, the procuring an elevation into the bosom of the air, they all proved equally inefficacious, until the discovery of the balloon by the brothers Montgolfier in the year 1782. Two instances, indeed, and but two, are authentically recorded, in which the attempt to fly by mechanical means has been attended with partial success—that of the Marquis de Bacqueville, who, in the year 1742, accomplished a flight partly across the Seine in Paris, and that of an individual of the name of Degen, who, at Vienna, some years ago, succeeded in raising himself to a height of about 50 feet by means of the alternate reaction of large surfaces shaped after the fashion of an umbrella, and worked by the exercise of the arms and legs. These, however, were but the more splendid failures; and the prospects of aerial navigation may be said to have been at the very lowest ebb when the ingenious discovery of M. M. Montgolfier, with the subsequent improvements of M. Charles, in which hydrogen gas was made to take the place of heated air, revived the drooping spirit of enterprise with the promise of a more easy triumph in the fields of air. Abandoning the former mode of operating for the purpose of obtaining an ascent, men now directed their attention entirely to the means of controlling the motions of the machine, by the intervention of which that, apparently the most arduous and perplexing condition of atmospheric transport, had been so suddenly and unexpectedly accomplished.

In this, however, as in the more independent processes of flight by mere mechanical reaction, human ingenuity was doomed to be defeated. With all the flattering prospects of success which an almost unlimited power of support appeared to hold out, not only was there no commensurate progress in the essential object of securing a definite direction, but even greater difficulties appeared upon further acquaintance to stand in the way of aerial guidance by means of the balloon, than were apprehended, before that instrument had brought men into a more practical acquaintance with the character and conditions of the element with which they had to contend. The magnitude of the forces developed, owing to the necessary bulk of the machine, seemed to deride all attempts at control, while at the same time the expenses attending its construction and employment, imposed a limitation upon the experiments, by means of which alone these obstacles could be expected, if ever, to be overcome. Under these accumulated and, perhaps, insurmountable difficulties, the balloon gradually ceased to be regarded as an object of scientific interest, and at length shared the fate of all other discarded favourites, in a neglect as inconsiderate as it had formerly been courted and admired.

After a period of excitement, a state of lethargy is no uncommon result; and accordingly when the first burst of admiration and wonderment had subsided, and a succession of failures had begun to characterise the new art with something like a tinge of absurdity, the public gradually settled down into a condition of apathy and disregard in respect of aerial navigation, even the more profound from the greatness of the disappointment to which they had so recently been subjected. Occasionally, indeed, the rumour of some new improvement in the art of "flying made easy," more plausible or presumptuous than the rest, would startle them from their propriety, and, for a while overcoming their antipathy to the balloon, awaken a languid spirit of speculation, in which the dread of disappointment could plainly be seen predominating over the feebler expectations of success. These, however, were but temporary excitements, which died away as soon as they were felt, and the subject appeared to have been almost entirely forgotten, except by a few of the most ardent cultivators of the art, when the announcement of a *really new* project, totally unlike any that had gone before, and repudiating all connexion with the obnoxious instrument by which they had been so often before deluded, has again roused all their sympathies, and produced a fever of expectation which a month of cool reflection has not yet been able to allay.

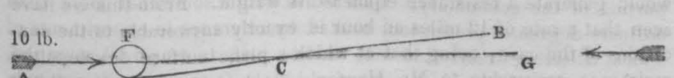
The first communication of this project in a tangible form, having taken place since the publication of our last number, [1] we were precluded from giving it that notice at the time which we would otherwise have bestowed upon it; not only as in itself meriting investigation, but in consideration of the intense interest and divided opinions it had certainly excited throughout no small nor uneducated portion of the community. Ushered in with a somewhat more than ordinary degree of pretension, backed by reference to experiments of a most flattering description with models, and, to crown all, stamped, as it were, with the authority of a bill in Parliament, it not only justifies but imperatively calls for an inquiry which, to be available, must be equally searching and exact. It is of no use to regard a scheme of such complicated contrivance and involving such recondite principles, in a superficial manner or in a general point of view. The mere fact of a principle being correct is no proof of the practicability of a scheme which is founded upon it; and if the success of a *model* were conclusive in respect of the object it is intended to represent, neither would Mr. Cocking have perished in the descent with his parachute, nor would this very question of aerial navigation have remained undetermined to the present day. [2] In fact the working of

[1] The public were first made acquainted with the details of Mr. Henson's patent through the plans and descriptions which appeared in the weekly journals of that rather ominous date, the 1st of April.

[2] It is well known that Mr. Cocking had spent upwards of 20 years in framing and improving models of the machine in which he afterwards lost

a model determines nothing that cannot as well be determined without it—the correctness of the principle, which is the proper subject of mathematical research. With regard to the possibility of its construction upon the great scale it would determine nothing, even if it were, which in this case it is absolutely impossible it should be, in the strict sense of the word, a perfect model, observing all the proportions of strength, weight, bulk, power and dimensions as they will appear in the real machine with reference to which they are contrived. The only true and satisfactory mode of arriving at any thing like a correct conclusion respecting the efficiency of the machine in question, or any other of the like character, is by a critical examination of its parts severally and with reference to each other, which is the course we intend to pursue on the present occasion. To enable us to do this the more intelligibly, we will begin by describing in a few words what Mr. Henson's machine is, and what is the principle upon which it is intended to act, so far as they can be collected from the statements in the public press. In general terms, then, Mr. Henson's machine may be described as an horizontally extended plane, 150 feet in length and 30 in breadth, (consequently containing an area of 4,500 square feet) across which, close beneath and in the centre, is suspended a cuneiform car or body accommodated with a pair of circular flying vanes, by the oblique impact of which against the air (upon the principle of the archimedean screw) it is designed to be propelled, and furnished with two caudal appendages like fans, one of a large and the other of small dimensions, by means of which the vertical and horizontal course of the machine is intended to be controlled. The whole is proposed to be set in motion by an accession of extraneous force acquired through the intervention of a preliminary descent down an inclined plane, and maintained by the operation of a steam-engine located in the body or car of the machine. Omitting therefore the consideration of minor details, our attention will be directed, in succession, to the suspending plane—the caudal appendages—the flying vanes—the motive power—and, finally, to the principle upon which the elevation in the first instance is intended to be secured.

And, first, with regard to the suspending plane. The object of this contrivance, involving, in fact, the essence of Mr. Henson's patent,[3] is, simply, to obtain a *direction* for a certain amount of weight different from what it would assume if left to pursue its course according to the unobstructed force of gravitation. This it accomplishes, or would accomplish if efficiently constructed, by a progressive motion conferred upon it at an angle inclined to the horizon, whereby a part of the force generated by its opposition becomes resolved in a direction opposed to its descent; and the merit of it consists in this,—that a less degree of force is required to produce this progressive motion than that which the actual weight of the machine would require for its support. A familiar mode of illustrating this has been adopted by Sir George Cayley, in the *Mechanic's Magazine* for the first of April. It proceeds upon an analogy with the suspension of spherical substances upon an inclined plane, and cannot be better explained, as far as it goes, than in his own words. "Suppose A B to represent an inclined plane,



rising one foot in ten; it is well known that if the ball F weighed 100lb., a force of 10lb. applied horizontally would sustain it from rolling back. Conceive the same line A B to represent, also, the section of a large surface, like the sail of a ship, and that C G represents a cord by which it is sustained from being driven back by a horizontal wind in the adverse direction. If the sail contains 100 square feet of surface, and the wind has sufficient power to press with one pound to the foot, 100 lb. weight will be supported, and the tension on the cord will be only 10 lb. It is the same thing whether the wind thus blows against the sail, or the sail be driven with equal velocity horizontally in calm air; the 10 lb. propelling power will still sustain the 100 lb. in the air." It only remains to observe in what manner it effects this; namely, by producing such a rate of motion in the inclined plane as, at the given angle, would generate a pressure of one pound to the square foot.

Now to apply this to the case of Mr. Henson's machine. In the first place, the area being 4500 square feet, and the weight (taking it according to the statements in the public prints) being 3000 lb. supposing the same angle of inclination to be observed as in the foregoing illustration (that is to say, one in ten) if the wind move at a rate sufficient to generate a pressure equal to two-thirds of a pound upon the square foot, the resistance to its horizontal progress, and consequently the force it would require to compete with that resistance, would be one-tenth of its actual weight, or 300 lb. If, instead of an angle of inclination of one in ten, be substituted an inclination of one in twenty (which is perhaps more nearly in the ratio observed by birds in their flight, and consequently more consistent with the analogy Mr. Henson appears most desirous of maintaining) the same result will be obtained with half the force, or a resistance of 150 lb.; and accordingly it is upon this hypothesis that we shall proceed, in the next place, to investigate the rate at which the machine must be propelled in order to enable it to realize this resistance.

The proposition which we here have to deal with is simply, "having the pressure upon a plane surface at a given angle of inclination, to find the *rate* under which that pressure is developed;" and the solution is deduced from a consideration of the rate corresponding to the resistance the same plane would experience if perpendicularly impinged upon.

We will not trouble our readers with entering into the details of the equations by which the ratio of the forces generated by inclined planes moving in fluid media has been determined; but, content with referring them for the solution of these interesting problems to Whewell's Treatise upon Dynamics (or indeed any other works of good repute upon the same subject), proceed at once to observe that the resistance experienced by an inclined plane in passing through the air with a given velocity, varies as the cube of the sine of the angle of impact; and that, consequently, whatever be the ratio which this number bears to the cube of radius (the sine of the angle of 90 degrees), the same will be the ratio of the resistance it will experience at the angle assumed, to that which it would experience at the same rate of motion if perpendicularly encountered.

Now the velocity under which the plane in question, containing an area of 4500 square feet, would develop the prescribed amount of resistance, namely 3000 lb. by perpendicular impact (being at the rate of two-thirds of a pound per square foot) is, according to the tables of Messrs. Rouse and Smeaton, founded upon actual experiment, about 12 miles an hour. The angle of inclination at which we have agreed to dispose the suspending plane, being one in twenty, may be considered with sufficient accuracy for practical purposes, as an angle of 3 degrees, the sine of which (radius being estimated at 1) is ·05 As therefore $1^3 = 1 : \cdot05^3 = \cancel{\cdot000125} : : 3000 : \cancel{\cdot375}$ = the resistance on the inclined plane at the rate of 12 miles an hour; and the resistance increasing as the squares of the velocities and consequently the velocities following the ratio of the square roots of the resistance, as $\sqrt{\cdot375} = \cancel{\cdot6}$; $\sqrt{3000} = 55 : : 12 : \cancel{1100}$, the number of miles per hour representing the rate of the inclined plane required to support it, in conformity with the conditions described.

The consideration of some of these conditions will, however, show that this rate of motion, and, consequently, the amount of force by which we have presumed it to be generated, is far from sufficient to

his life; and the public will not yet have forgotten the pleasing experiments with Mr. Green's model of the balloon at the Polytechnic Institution last year, in which the practicability of controlling its course by mechanical reaction was so interestingly illustrated.

[3] It is not our desire to detract from the merits of any individual who seeks by his ingenuity to extend the limits of our attainments in art or science; but a regard to truth obliges us to observe that the idea of obtaining an ascension by means of the inclined plane is not original or peculiar to Mr. Henson's project; being in fact the mode to which all those who of late years have thought to effectuate an aerial navigation by mere mechanical reaction, have looked for the solution of this interesting question. In the number of the *Mechanic's Magazine*, for the 25th April, 1829, is a sketch of an apparatus constructed entirely upon the same principle, and many more might be referred to of an earlier as well as a more modern date.

satisfy the exigencies of the case. In the first place, the data upon which the calculations of the resistance of the atmosphere have been grounded, are deduced from a consideration of the density under little more than mean pressure, equivalent to the support of a column of mercury 30 inches in height; whereas it is well known that it frequently, or at all events occasionally, falls to an extent of nearly two inches, implying a reduction in the density equal to $\frac{1}{15}$th of its whole amount. In respect of this condition alone, therefore, 25 miles per hour would have to be added to the above to enable the machine to maintain its pristine elevation, *but slightly removed above the surface of the earth.* But the mere retention of this elevation, without the power of augmenting it at will, within certain limits, would be evidently very insufficient for the purposes of a perfect aerial navigation. It is unnecessary to dwell upon the many occasions which the inequalities of the earth's surface would present, in the extancy of the objects upon it, both natural and artificial, when it would be necessary to assume a higher course in order to escape a collision. Some of these, it is true, could be *gone round*, and thus avoided, instead of being surmounted. But there is still a great variation in the prominence or altitude of the plains and large ranges of mountain country, which could not be so dealt with; and in respect of these, a considerable allowance must be made in the powers of the machine. No part, for instance, of the Alps or Pyrenees, extending entirely across Europe, could be traversed under an elevation of 8000 feet, and without the power of accomplishing this, the use of the machine would be restricted to a very small portion of our own continent, or forced to make a *detour* equal in some cases to perhaps the entire extent of its intended route. Now for every 1200 feet of elevation, in the beginning of the scale, a reduction of one inch may be counted upon in the height of the barometrical column; so that if we only presume an elevation of 8000 feet, we shall have imposed upon the aerial machine an obligation of conducting her operations in an atmosphere the density of which will have been reduced to an extent indicated by a fall of the barometer to 23 inches; from which, if we further subtract the amount of the variation from mean pressure previously mentioned, we shall have a density of the medium only three-fourths of that, upon the hypothesis of which her former velocity had been assigned. Now the pressure, according to the first law of resistances, being directly as the densities of the media, by this condition, therefore, we shall have incurred a fresh obligation of speed, following the ratio of the square roots of the densities, the total amount of which will be determined by the rule of three proportion; thus, as $\sqrt{3} : \sqrt{4} :: 1100 =$ the number of miles per hour necessary to accomplish the required resistance under mean pressure : 1246 miles (nearly), = the rate at which the machine must be impelled to enable it to effectuate the same amount of resistance under the reduced pressure to which, in its elevation, we have seen it will have to be exposed. And this augmented velocity, be it observed, arising solely out of the reduction in the density of the medium, will be maintainable by the application of the same effectual force, namely 150 lb., by which the first assigned velocity was shown to be determined.

Hitherto we have regarded the qualifications of the machine in respect of rate and force apart from any considerations but the necessity of securing an elevation in the air. But a velocity of 50 miles an hour, however it might satisfy the conditions of support, would evidently be insufficient to realize that progress independent of the action of the winds which is necessary to the constitution of a *certain* and *serviceable* mode of transport. For this purpose, something more than the actual rate of the winds is the least amount of speed which could be considered sufficient to meet the exigencies of the case. Now, the average rate of the winds, in this climate at least, may be stated to be about 25 miles an hour. This we are enabled to determine, not from the observations of the meteorologist alone, but also, (and what is more to the point because founded upon experience in that part of the atmosphere with which we have more especially to do) from a consideration of the average rate of Mr. Green's aerial excursions, [4] deduced from a series of 249 voyages, executed generally, of course, in the most favourable periods of the year. From this we learn that 25 miles an hour is the mean rate at which a body floating in the air may expect to be transported; to this we must add considerably more to secure a balance in favour of the machine, for which an additional amount of force must be provided over the amount assigned for its support.

The determination of this new quantity however depends entirely upon data with which we have not been furnished. In the calculations which we have hitherto made, we have regarded the machine as a mathematical plane, altogether unproductive of any resistance except what contributes to the counteraction of its descent. This, however, it is scarcely necessary to observe, is an hypothesis which is not correct in fact; and the distinction will be seen to be of serious importance, when we consider that, for every square foot of plane surface made up of all parts and projections that receive the direct impact of the air, the machine experiences, at the rate of 100 miles an hour, a resistance equal to about 50 lb.; so that if we only suppose it to present an additional extent of resisting surface equivalent to a plane of 10 square feet, it will encounter an opposition equal to four times what has already been assigned to it, and consequently involve a necessity for four times the amount of force which was previously required.

Now the conditions of *force* in the first instance prescribed might have been considerably (almost indeed, indefinitely) reduced by increasing the superficial contents of the suspending plane. For instance, if instead of an area of 4500 square feet, it had presented a surface of double the extent, (which it could have been made to do, by doubling the breadth or adopting another form, without augmenting the difficulties of construction,) the same degree of elevation would have been obtained with less than half the force; as will be evident if we consider that while the resistance follows the ratio of the dimensions, the dimensions observe the ratio of the squares of the velocities: so that in this point of view the suspending plane of Mr. Henson's machine may be shown to be contrived without due regard to the economy of the forces by which it is upheld.

But there is another purpose which the suspending plane is required to fulfil, and which must be taken into consideration in adjudicating upon the plan before us. It is to be recollected that this elevation is maintained only by the exercise of a progressive motion, and that in order to effectuate a safe descent this motion must be suspended. It is scarcely necessary to observe that a projectile force, however modified it might be, is quite incompatible with the preservation of human life under any mode of accomplishing a descent which could be proposed; and that unless it can be accomplished by the independent resistance of the suspending plane, it can never be safely accomplished at all. There are two modes by which the actual rate of descent may indifferently be ascertained. To one of these modes, which is an inference from the pressure exerted by the air in motion at different degrees of velocity, we have already adverted in determining the speed at which, under perpendicular pressure, the plane in question would generate a resistance equal to its weight. From this we have seen that a rate of 12 miles an hour is exactly answerable to the conditions of the case; being that at which a plane surface develops the resistance assignable to Mr. Henson's machine, namely, two thirds of a pound to the square foot; and accordingly that number expresses the rate at which the machine in question would descend through the air if left of itself to fall.

In addition to this method, Dr. Hutton has left us a formula by which the same may be calculated with sufficient accuracy for practical purposes, and which it will be seen leads to a result confirmative of the approximate correctness of our conclusions. Taking W to represent the weight and D the diameter of a circular plane of the given area, $\frac{26}{D}\sqrt{W}$ gives the number of

[4] "The total distance which Mr. Green accomplished in the course of his first 200 aerial excursions, a very accurate computation enables him to fix at 6000 miles; and the time consumed in the performance at 240 hours. The former of these two quantitise divided by the latter gives the result above." *Areanoutica*, page 298.

feet per second which constitutes the terminal velocity of the falling body. In the present case, D being equal to 76 feet and the weight 3000 lb., we have $\frac{26}{76}\sqrt{3000} = \frac{26}{76} \times 55 = 19$ feet nearly in a second, or somewhat less than 13 miles an hour. It is unnecessary to point out the insufficiency of this retardation to effectuate the safe descent of human beings. It will serve to give some idea of the force and necessary consequence of such a precipitation, merely to suggest the shock that would be experienced by an individual if he were to be launched unprotectedly against a solid wall from the top of a vehicle travelling continuously at the rate of 12 miles an hour. In this respect therefore, the suspending plane of Mr. Henson's machine is particularly deficient. It has been calculated, and no doubt upon good grounds, that the least rate of descent which consists with human safety is 3 miles an hour; and though if we could always command the conditions of the descent so as to alight upon our legs, we might be able to sustain a greater concussion without peril, yet, as a general principle, and more particularly with reference to the circumstances of the case before us, we shall not be too exigent in requiring a power of retarding the descent within double these limits. Now the resistance upon a square foot of plane surface in motion through the air at the rate of 6 miles an hour, is ·176 of a pound; and the whole weight to be sustained being 3000 lb., we shall have an apportionment of surface to weight in the ratio of about 6 feet to the pound; amounting in the aggregate to an area of 18,000 square feet, or 4 times the actual size of Mr. Henson's plane. The correctness of this estimate may be readily verified by reference to Dr. Hutton's formula before adduced, by which it will be seen, that such is the rate at which such a plane so loaded would make its descent through the air.

But for the continuation of these investigations we must refer the reader to our next number.

THE CAUSES WHICH HAVE ENNOBLED ARCHITECTURE.

By FREDERICK LUSH, Associate of the Institute of British Architects.

AN art which depends upon the cultivated powers of the human mind must be necessarily slow in arriving at perfection. As it had its origin in some simple want, its primary object is to satisfy the necessaries and promote the happiness of man, in whatever condition he may be placed. The end of architecture, like all other works of imagination and taste, is to give pleasure; but it will fail doing so, when this principle is lost sight of. On this account the expression of use and fitness has been considered by all writers on art, as the chief element of beauty: and we expect to find that the buildings of different nations will be indicative, not only of their peculiar habits and customs, but also of the country in which their several styles originated. There is no occasion to speculate on the influence which scenery and climate exert upon the mind, and how they consequently operate upon all the productions of man. The difference of opinion and degree in which the sentiment of the beautiful has unfolded itself in various parts of the globe, plainly shows that the temperature and circumstances of one clime are more congenial for the practice of this noble art than another. Nature scattered her beauties on the soil of the Greeks with a liberal hand, and as they were quick to discern and appreciate them, they were wrought by the sculptor on their temples and monuments. The embellishments with which they were thus supplied, were in harmony with surrounding objects; and we cease to wonder at the fascinating works which emanated from this favoured people, when we see that the finest models in nature were ever present to their imagination. Among these resources, none gave them, perhaps, greater power of conceiving what was beautiful, than the various passions, attitudes and proportions, which they had the opportunity of studying during the exercises of their athletæ. Here was exhibited to their astonished gaze the wonderful structure of the human frame; and it is when contemplating the character which man sustains in the varied scenes of life, when watching the many ways in which his hands are employed for advancing the good of his fellow-creatures, or, when he breathes and speaks to us out of the marble or canvass, that we recall to our memory the fine soliloquy of Hamlet: "What a piece of work is man! how noble in reason, how infinite in faculties! in form and moving, how express and admirable! in action, how like an angel! in apprehension, how like a god! the beauty of the world, the paragon of animals!" Who can deny then, that an anatomical knowledge of the human figure is the best education for the eye, and the basis of all grace and propriety in invention and design? The student needs to be reminded that his art will never be ennobled by only copying the orders of Vitruvius or Palladio. If the works of nature had not been their guide, the ancients had never attained to such perfection in architecture.

One of the most striking features in ancient art is grandeur. It was an object with the builders of antiquity to give great permanence to their works: a wish which sprung out of their natural love of glory and desire to appear great and enterprising in the eyes of posterity. An instance of the extravagance to which this passion carried them, is recorded in the tower of Babylon. Such a failure, however, occurring among men who were unguided by precedents and blinded to the consequence of their rash and presumptuous undertakings, would have the most beneficial results, and lead them to view the art of building *for eternity*, on more sound and philosophical principles. Curiosity has ever been busy in inquiring into the causes of things; and the most useful discoveries have arisen upon the errors of former ages. Michael Angelo had never, perhaps, raised a dome so triumphantly, if the attempt had not been made by others with less success before his time.

But although this sense of immortality is the first step towards a grand style, it depends likewise upon the goodness of the materials that are introduced, as it is these which give to buildings, whatever may be the purposes for which they are intended, all their character of strength and durability. Now, on these latter points, much of the fame of an architect rests, and for want of attention to them, we owe the ruin of many modern edifices: I allude to the one at Fonthill as an example most familiar to the reader. Every one remarks the great contrast between the size and dimensions of timber, for instance, used in buildings of a bygone age, with those of the present day: and the difference in their duration is equally great. The system of contract, which has been so prevalent of late years, and the heavy duty on materials of every kind, have operated powerfully in the change; and although in some cases the exorbitant proportions of strength observed in old houses seem to indicate an ignorance of the principles of construction, yet as they long outlast our feebler erections, and require force to raze them, we can scarcely blame what appears in some of their parts a want of geometrical skill. The architectural merits of our ancestors must be judged by the circumstances of the age in which they lived. They had doubtless been more sparing, and displayed more science in the use of their timbers, had they been less abundant; or had they been compelled, by the restraint of taxes, to make them answer their several ends with the least possible expenditure.

With regard to stone, we have no cause to complain of its deficiencies, or think lightly of the resources of our British quarries, although we have not the granite of Egypt or the marble of Pentelicus. Yet when we look on the dilapidated state of many of our edifices—when we think of the ruinous appearance of some of the colleges in the beautiful city of Oxford, the nurseries of so much profound learning and eminent piety, we have reason to lament the corrosive nature of the stones with which they have been constructed. In these latter, their rapid decay is owing to the broad surfaces of the laminæ or cleaving grain being presented to the action of the weather; and we see the result of placing them in a position contrary to that in which they lay in the quarry. One remedy for this evil would be the establishment of a society for testing the capabilities of stone and its fitness for durability, prevous to its being employed on public and national edifices.

On the other hand the mild and equable temperature of the east was favourable in effecting for the ancients that perpetuity at which they aimed; they did not suffer from frequent frosts and sudden changes; their beautiful statues were not injured by that quantity of coal-smoke which accumulates in our dense cities; nor did they see a Parthenon or Erectheium perishing in the lifetime of its founder. Instead of a few years altering the appearance of their temples, they remained as firm and perfect as ever after the lapse of centuries, and promised to be as lasting as the rocks out of which they were originally hewn. The immense size and weight, moreover, of the stones which their architecture demanded, contributed, independent of the cement, to the stability and breadth of the masses. And as the site of their cities was generally on the tops of lofty hills, it being the custom with idolatrous nations to offer sacrifice on such places, it is evident that to raise such huge blocks to the required height, betokened some degree of mechanical skill. Besides, when they knew the grandeur of effect which would be conferred on their buildings from an elevated position, and the advantages it would give them over invaders, they needed not a further stimulus to exertion; nor would they be slow in applying the principles of geometry to the carrying forward those great works. The Egyptians were unquestionably masters in this science. But their simplest and most effectual method in transporting their vast monoliths (as may be learned from one of their own paintings) was the use of rollers and the incline; in fact they would *skid* these obelisks, and by means of proper tackle, set them up just in the same way as modern labourers.

If we consider their cement, we find, as in the aqueducts, it presents a hardness that is impenetrable to water; and this through no less than 2000 years. The Romans and Greeks were particularly careful in the making of their mortar and in the use of it; with us, on the contrary, it is deemed a second rate consideration, especially in house-building, and is usually committed to the least instructed class of men. Allan Cunningham, in his life of Wren, speaking of St. Paul's, says:—"Though the stones are hewn with the greatest nicety, and the masonry seems all firm and compact, yet the mortar which should unite the whole into one solid mass, is in many places decayed and become as dust. This is the case even with some of those piers against which the public monuments are erected; when the outer line of stone is cut through, the mortar comes gushing through the aperture; the sand is sharp and good, but the lime, like too much of the lime used in London, has been deficient in strength." Notwithstanding this defect, every one who knows that the architect endeavoured to give permanence to his works and secure the praise of posterity, will be glad he is deaf to the voice of his biographer.

Of the religious edifices of the middle ages, there are some which retain, despite of time and tempest, so much of their original beauty, that most of their ornaments and rich carving seem as if they were the work but of yesterday. There are even preserved to us those curious devices with which the early sculptors were wont to decorate their handy works; and whether they alluded to the mysteries of their craft, or were emblematic of some moral truth, were yet always used to mark and identify a favourite subject. I regard their sacred architecture with feelings of reverence; for cold, indeed, must be the heart of that man who is insensible to the sublimity of the Gothic, when looking upon the roof at King's College, the Minster at York, or the magic groining and tracery of Henry VII's chapel. There is something so ennobling in this style, that it is peculiarly adapted to our Christian churches. It is easy to point out its claims upon our admiration. The Gothic architects, well knowing that devotion would be heightened by great size, loftiness, and durability, preserved all these characteristics of grandeur; and it is when surrounded by them, we are impressed with the religion of the place, and feel that we are in a building dedicated to the worship of Jehovah. Everything is calculated to excite the most profound emotions. Worldly feelings die away, and piety grows warm when we view its consecrated walls through the obscure and subdued light which streams through the painted windows; when the voice of prayer alone breaks the stillness of its ailes; and, as the sounds of the organ thrill through our souls, we listen to the beautiful and affecting chaunt:—

Stabat mater dolorosa
Juxta crucem lacrymosa
Dum pendebat filius, &c.

During the period of the building of these magnificent structures art was the favourite study of the monks, and the most eminent architects were bred within the walls of the cloister. The abbeys, the cathedrals, and conventual churches, were planned and superintended by successive abbots and bishops; for learning then was a kind of monopoly, and chiefly confined to the clergy, and the nobles of the land. But this was a propitious era for architecture, inasmuch as there was less fear of its being debased by illiterate men. The knowledge of its principles, too, seemed to operate far more powerfully, when concentrated in such a circle, than when scattered in various forms over a whole community. It is thus that the noblest style and the most perfect system of architecture, as seen and universally adopted throughout Europe, is supposed, and with every probability, to have originated among the fraternity of freemasons. For such could only have been accomplished by many different minds acting in concert.

Nor were wealth and labour among the least causes which contributed to this end. To command them is indeed the object of every nation eager of renown, and desirous to distinguish itself by its public institutions and monuments. We admire the beautiful villas of Italy, her lakes and gardens, her palaces and academies for the arts, and we think of the rich cardinals and noble families who built them; we look at other stupendous fabrics and are reminded of the wealth of the Roman patricians. The prelates, too, of the great Catholic churches, from being prohibited to marry, had no motive for accumulating property, but expended it on the service of the altar; and aided by the munificence of princes, the donations of the people, and the revenues arising from monasteries, they were enabled to seek out, from both at home and abroad, the most skilful artists, for the purpose of making those edifices in all respects worthy of religion. Such a capital was applied by the Gothic architects for their embellishment. That unrivalled skill in construction—that elaborate ornament in sculpture, and those beautiful allegorical and legendary decorations, arose from this source. The interior of their churches became one mass of splendour; to compose them, the priests exhausted their knowledge of the passions; and with it they exhausted their fortunes.

The time and labour which were bestowed upon them equally deserve our attention. In our contemplation of any object to which genius has given all the excellence it is capable of, we seldom reflect upon the numerous difficulties through which it has struggled to perfection; although what appears as the effect of enchantment or produced without any effort of the mind, is generally the fruit of many years of painful toil. Those who witnessed the foundation laid of one of these great piles, and those who saw the last stone raised for its completion, were almost two distinct generations. During this long interval, separate portions were built at different times and by different hands; and this was especially the case under the Papacy; so that we find in the history of the cathedrals, a succession of bishops who added some screen, shrine, tower, or transept, in the design of which, they acquired great fame as architects.

This mode of building by degrees is at present rare amongst us. It has been lately followed in one or two parts of England; but the recommendation of it by the "Incorporated Society for promoting the Building of Churches," is likely to lead to its more extensive practice. The only evil that is to be feared will result from it, is the want of unity in design; as we see it in St. Peter's and other works in which this system was pursued.

(To be continued.)

CANDIDUS'S NOTE-BOOK.

FASCICULUS XLVIII.

"I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please."

I. It is curious to observe how much fashion and custom prevail in matters where they ought not to be allowed to have any authority. It is still the fashion to talk of Michael Angelo as a "great architect," and he is accordingly considered quite a luminary in that character—a mistake of which some of our now rather numerous Professors would do well to disabuse the public; at any rate those who can admire him and his caprices have no right to turn up their noses at those of Borromini. It is the fashion—with book-making tourists more especially—to extol Palladio, generally in "criticism pilfered from guide-books." And as it is also the fashion to make no mention of Calderari, or any of the buildings designed by him in the same city of Vicenza, the unfortunate Count Ottone is treated as a mere nobody. For tourists of the Trollope breed, who make trading voyages of their travels abroad, and who are content to return home with as much gossiping and blundering as will serve them for a book-making and book-selling job—for such persons there may be an excuse, since, if ignorance can be pleaded as a sufficient one, they may generally claim it most amply; but that a professional man, and one who made architecture the chief object of his journey, should not even so much as once mention Calderari or any work of his either at Vicenza or Verona, is almost incredible—certainly quite unpardonable. Nevertheless, after speaking of Palladio's buildings in the last-mentioned city, Woods says, "I will not trouble you with criticisms on other palaces, where there is nothing particularly beautiful to render them objects of study." Pitiful and humbugging evasion! Did he mean to say that Calderari, a decided *Palladianist* in his style, produced nothing that will bear any comparison with Palladio's own works? If such was really the case, that should have been a reason for his entering into the subject, and explaining wherein the great difference consists, and to what it is owing that, with far fewer solecisms and defects, Calderari's buildings are decidedly inferior to those of Palladio. This might have been rendered a highly interesting and instructive piece of criticism, therefore we may fairly suppose that Woods' reason for passing over Calderari was not that which he has assigned, but the unwillingness to "trouble" *himself* with any farther remarks on the subject of the palazzo architecture of Vicenza. The only mention at all I have ever met with respecting Calderari, in any English book, is—*pace* Joseph Gwilt—in an article on the "Palladian Architecture of Italy," in the *Quarterly Review*, where it pleases the "ignorant reviewer" to remark, "Ottone Calderari particularly distinguished himself by simplicity and elegance, and a knowledge of the true principles on which the beauty of Grecian architecture depends. The Loschi and Bessaro palaces at Vicenza, and the Seminario at Verona, are noble specimens of his skill." Where then were Woods' eyes—where those of the hundreds of others who have visited Vicenza only to prate like so many parrots about Palladio? It is just as if a foreigner, visiting England, should extol Temple Bar as a work of the "great Wren," and of course a perfect architectural gem, yet should not bestow a syllable upon the *palazzi* of Pall Mall. As to Buckingham Palace, the less any one, either foreigner or Englishman, says of that, the better. It is a thousand pities it was ever built, and at least five hundred that it has not since been burnt down.

II. The plea of insanity is now becoming a very fashionable, and is certainly a most convenient one. For some of the things they designed, both Nash and Soane, not to speak of a good many others, deserved to have been hanged; and if tried could have escaped only on the grounds of positive insanity. But then, those who employed them ought to have been hanged too—at any rate, ought to have been shut up in Bethlehem, as being equally insane. Oh! the untold millions squandered away upon lost opportunities! Let us not think of it, for it is enough to drive us all mad, and qualify us for the glorious *privilege* of insanity. Apart from their architectural phrenzies, there was, however, little in common between Nash and Soane; the one lived *en prince* and died a beggar, the other lived very much like a hunks and left a vast fortune, which he most assuredly would not have done could he by any possibility have carried it away with him. I well remember once being witness to a complete *scena*, in which Soane was the actor. In reply to some complimentary remark about his house, he burst out with "D—n the house! curse the house! Could I have my mind, I would tear it all to atoms this very instant—yes, this very instant. I am sick of hearing of it—I abhor it—I detest it—I loath it—I abominate it. And so you are come to see the house?—here is a d—d dull day to come on such an errand. 'Tis as dark as pitch—as black as Erebus. Confound the house, it is my eternal torment, and a parcel of folks are continually coming here, to see the d—d house: they don't come to see *me*—no, I am nobody, they only come to stare at the d—d, infernal, abominable house!" After which furious explosion, and tempest, the old man suddenly became not only tranquil, but very condescending, gracious, and chatty. If he was really mad, there was also a certain degree of method in his madness, and a most extraordinarily queer method it was. "Rich and rare" are the anecdotes that remain to be told of Sir John Soane. I know one who promised to give a collection of them to the public, but he has not kept his word.

III. Independently of the egregious blunders with which it teems, the English translation of Milizia's Lives of celebrated architects, would disgrace a penny-a-liner. That work has been *done* into English, with a vengeance. It seems to have been done by way of exercise while the translator was learning Italian, and in all probability such was really the case. The best part of the book is the index, which as matters go, is saying something in its favour, indexes, even to books of reference, having now gone almost entirely out of fashion. No matter, this is an age when, thanks to the march of intellect, everybody reads and nobody studies.

IV. So Albert has actually shed the light of his countenance and the glory of his presence on the Institute of British Architects; yet his visit to it turned out one of the dullest and flattest affairs imaginable. If the Institute really felt flattered or encouraged by it, they must be the most easily satisfied mortals breathing. Of course all was conducted very "properly;" no blunders were committed either on the one side or the other. The Prince was exceedingly prudent and discreet—which for a Prince, is saying something: he did not attempt any compliments; he did not pretend to congratulate the Institute on their unwearied zeal, and on what they had done for the advancement of architecture in this country. In abstaining altogether from *blarney*, his Royal Highness showed good taste, but he certainly did not manifest the slightest cordiality or sympathy with them. The whole affair was mere matter of form and ceremony—at once perfectly correct and intolerably chilling. The Prince seemed to consider it a bore—how the others relished the taste they got of Royal condescension and patronage, I pretend not to say. There was, at all events, a paragraph for them in the newspapers and *Court Circular*; but as to the patronage itself, that is likely to turn out a mere phantom—of just as much real service to the Institute, as the Institute itself is to the art and the profession.

V. "I cannot recommend frescos," says Mr. Eastlake, "for the sitting rooms of dwelling houses;" a very reasonable piece of advice, now that we seem to be threatened with a fresco mania. If that mode of painting is to be employed for the merely general decoration of walls, it would soon sink to the level of paper-hanging, and its greater pretension would chiefly serve to render it all the more paltry and unsatisfactory. On the other hand, if it is to be employed for subjects upon a large scale, and with figures of the size of life, it would be a most obtrusive and oppressive species of decoration. In that respect painted ceilings are objectionable enough, but they are comparatively quite removed from notice. Saints and virtues may cut capers over our heads, and dance jigs in the clouds, without our being compelled to look at them; but it would be very different were the walls of our rooms to be peopled with such figures—poetical or historical, and converted into so many "scenes." Pictures in frames do not force themselves importunately upon our attention: while they contribute to general embellishment, they do not *insist* upon being looked at; but we may do so or not according to the humour of the moment. Few would relish dwelling in rooms where the same scene, be it either solemn or the contrary, is constantly acted before their eyes. However masterly the paintings themselves might be, they would soon sicken of being shut up in a Miltonic "Paradise" or "Pandemonium," or a Dantean "Inferno;" while a perpetual Elysium would be likely to inspire them with the blue devils. Nay it is not every picture that one would care to have hung up in a drawing-room or other domestic apartment: the "Lazarus" of the National Gallery, for instance, would not be particularly desirable or exhilirating as a companion in such a place. It is all very well to talk about fresco-painting and the grand style of art; yet it does not follow that we are bound to admit them into our houses. They neither suit us, nor do we suit them; which may be unlucky, but is nevertheless the case. The truth is, we are a very matter-of-fact people, and live in a very matter-of-fact age; nor will all the arguing in the world render us otherwise, for we might as well attempt to change the natural atmosphere, as the moral one which surrounds us. It is very easy to say, let us revive this, or revive that; but how are we to infuse actual life and vitality into that which has been extinct long ago? The utmost we can do is to conjure up the mere ghost of it, and for ghosts the world has now little relish. The king of Prussia is now endeavouring to revive the Greek theatre and Greek drama in their pristine purity; and he will do so—but how?—precisely after the manner in which Eglintoun brought back again the age of chivalry, with its pageants and tournaments. It would perhaps be wrong to say that art in this country is not yet *ripe* enough for fresco painting, since it is more likely to be too *rotten*.

SUGGESTIONS FOR THE MORE EXTENSIVE EMPLOYMENT OF CONCRETE IN DISTRICTS WHICH DO NOT POSSESS ROCKS SUITABLE FOR BUILDING PURPOSES.

It is now many years since our active neighbours, the French, undertook on a very large scale, the manufacture of artificial hydraulic limes, with a view principally to introduce them as an ingredient into that species of concrete which they have termed béton. Following in the track of Berthier, Vicat, and Treussart, our own countryman, General Pasley, has long since endeavoured to arouse the attention of landed proprietors, engineers, architects, builders and others, to the method of forming artificial cement, by the mixture of chalk and clay in certain proportions, which should vary according to the qualities of these two ingredients. Hitherto, however, notwithstanding the perfect success which has attended the manufacture in the neighbourhood of Paris, where it is carried on at this day on the very same principles as those which General Pasley first had the credit of introducing to this country, nothing has yet been done by ourselves to carry out the practical application of a process which is evidently calculated to afford a very fine field for the employment of labour, the exercise of skill and ingenuity, and the profitable investment of capital.

Under the general head of calcareous concretes may be classed all those substances which are composed of fluid mortar mixed with broken stones, gravel, pebbles, fragments of bricks and tiles, or such other hard mineral substance as may be at hand. An ordinary concrete is that which is made from a common chalk or other lime stone which does not possess the property of setting under water. On the other hand, the quick setting limes, and those which possess hydraulic properties, as the Barrow lime, the Aberthan, that of Lyme Regis, and other places, as the lias formation, compose the species of concrete which is termed béton. Now it is known that all the limes which have been mentioned, owe their hydraulic property principally to the presence of a small quantity of clay in intimate combination with the lime. Hence it is that Roman cement, which is burnt from an argillaceous limestone containing more clay than any of the before-mentioned, and indeed more than any of the rocks properly called limestones, forms in concrete a more perfect kind of béton than any other. Conceiving an ordinary limestone to form a simple concrete, and conceiving Roman cement to form a true béton, all other kinds of limestone may be considered capable of forming a mixture intermediate between simple concrete and true béton, according to the proportion of argillaceous matter they contain.

It is quite a mistake to suppose that the béton so much in use throughout France, Holland, Italy, and other states on the continent, is invariably composed of broken stones mixed with lime, &c. Such appears to be a mistake into which O. T. of Newcastle has fallen in his paper on concrete, in the *Journal* of February last, since he observes "that béton differs from concrete in broken stone being used instead of gravel, in the proportion of two of stone to one of lime or pozzolana of Italy, &c." Now the truth is, that although broken or angular stones are commonly used in the manufacture of béton, yet gravel and pebbles are not unfrequently made use of; and the real and true distinction between concrete and béton lies, as we have already said, in the employment for the latter of a more or less hydraulic lime instead of a lime made use of for ordinary mortar.

Among the best of the hydraulic limes employed for the French béton, may be mentioned that of Metz and that of Senonche near Dreux. The hydraulic limes of Tournay in Flanders and of Viviers upon the Rhine, are also of excellent quality. The hydraulic limes manufactured in the neighbourhood of Paris are composed of three parts of chalk ground into powder, and made up into paste with two parts of plastic clay. This mixture is formed into cakes, burnt in a kiln, and then ground to powder.

APPLICATION OF CONCRETE TO BUILDING PURPOSES.

The Romans extensively employed concrete not only in building walls of every description, but even constructed vaults and arches entirely of this substance. Examples of this are found in the remains of their baths, their theatres and temples. The arches in the Coliseum, in the baths of Caracalla, in the temples of Peace, of Minerva, and of Venus, are mostly of concrete with an occasional rib of brickwork.

The spherical vault of the Pantheon at Rome, which is 133 Roman feet in diameter, and also a great vault at the baths of Dioclesian 74 feet in diameter, were both built of concrete, and their condition is as perfect at this day in point of stability as when they were first erected. A more modern example exists in the great concrete vault for the dome of St. Peter's, which is 82 Roman feet in diameter, and 144 in height. While admitting that the excellent preservation of many Roman walls in Italy, Spain, and the south of France, clearly proves the almost imperishable nature of the concrete or béton of which they are composed, it has been objected by many modern architects, that the variable climate of Great Britain is unfavourable to the duration of concrete in exposed situations, and the opponents of concrete have not hesitated to affirm that, if those Roman monuments, whose preservation we so much admire, had been tested beneath a more changeable sky, and exposed to the rigors of a more northern clime, they would have furnished far different evidence, that is, far less favourable evidence of the value of concrete for building purposes. In reply to this, however, it will be sufficient to adduce numerous old castles which were built in this country soon after the Norman conquest, and whose walls, consisting of irregular masonry, which bears a close resemblance to béton, are found at this day in a state of excellent preservation. The great Pictish wall, which is well known to have been executed by the Romans, is also a striking instance of the durability of well composed béton; and upon the whole we are justified in concluding from ancient remains existing in our own country, that where good hydraulic lime is employed, béton will last even in the atmosphere of Great Britain, for at least as many centuries as most of the stones at present employed for building purposes. We have observed in the walls of many old castles in England, that the stones have been greatly decomposed and eaten away by atmospheric influence, while the mortar joints stand out in relief and indicate what was originally the face of the work. In such cases the mortar has been obviously far superior to the stone, and this superiority is further evident, by trying the relative hardness of the two. While the stone will crumble away and yield to any metallic edge applied to it, the mortar can only be impressed with considerable effort. Now we do not hesitate to affirm that the same excellence as that for which the ancient mortar is so celebrated, has never ceased to be within our reach in this country, which is fortunately favoured by an abundance of the materials most proper for the purpose. In works of this kind the ancients had no secret with which we are unacquainted, but on the other hand, the researches of modern chemistry have brought to light a great deal connected with the subject of mortars and cements which in all probability our ancestors knew nothing about. The fabrication of artificial cements and hydraulic limes is entirely a modern discovery, and one of which the Romans were perfectly ignorant.

It appears quite clear, from all we can gather on the subject, that the superiority of ancient mortar depended chiefly on a judicious choice of good stone for the purpose of burning into lime, and afterwards upon careful attention to the manipulation of the calcined lime; and such being the case, there is no reason on earth why modern buildings of every kind should be constructed of materials less imperishable than those which our Roman and Norman ancestors made use of.

The great sea wall at Brighton, the dock walls constructed of concrete at Woolwich, and a church said to have been lately built near Brighton entirely of concrete, afford examples of what may be effected by this material. It is quite certain, however, that several circumstances have most unfavourably operated to retard the more general employment of this most valuable substance. Among the foremost of these, we cannot avoid referring to the patent which was taken out a few years since for forming concrete into artificial stones. The signal failure which attended the use of this artificial stone in some government buildings at Woolwich and other places, has too hastily led many engineers and architects to regard as impracticable the employment of concrete or béton for building above the surface of the ground. But let us observe the difference between small blocks of stone formed of concrete and the firm cohesive body which the substance presents when used *en masse,* as it always should be. The stones which were manufactured of concrete were found, as might have been expected, so tender and brittle at every corner and arris, that it was almost impossible to preserve them with perfect edges up to the time when they were set in the work. The process of setting them by mortar in the same way as ordinary stones, left these tender arises still exposed to injury, and it was no wonder that all along the joints a destruction of the walls took place to a very serious extent. It appears to have been the practice, in forming these artificial stones, to face them with a kind of plastering, which is said to have pealed off in great quantities from the action of frost and other external influences. We repeat that this absurd project for making concrete into blocks of stone has greatly impeded the real advantages of concrete from being properly appreciated. We protest, however, most strongly against any inference being drawn unfavourable to a judicious use of concrete from the failure of this attempt to form it into artificial stone.

According to the system of building with concrete, which we propose, the walls should in all cases have coins and coping of stone or brick, so that only a smooth plain face of concrete will be exposed. By adopting this method, no sharp corners or edges will be liable to injury from external violence, and there will be no irregularity or broken roughness in the work to admit the lodgment of moisture and occasion that injury which always takes place when frost ensues. To substitute a pile of separate cubical blocks of concrete for the solid mass of which a building may be at once constructed, appears to us in no respect more rational than the act of a man, who in proceeding to found upon solid rock, should break the rock in pieces, and join these pieces separately together, instead of founding at once upon the solid material. It may be said that we employ stone and bricks in cubical blocks of small dimensions, but this is a matter of necessity not of choice. Nature furnishes in the quarry blocks of stone, which have a fixed and limited size according to the natural beds, joints and fissures by which the strata have been divided, and in the case of bricks the convenience of manufacture, particularly with reference to the condition of being properly burnt, limits the size to comparatively very small dimensions. In building with concrete, however, no such limits exist, and there can be no comparison between the expediency of fabricating little detached pieces of concrete stone, and that of raising the whole mass of any house, wall, or building, by united and continuous layers extending without a joint over the whole area of the building.

In seeking for another cause why concrete or béton has not been successfully employed of late years in this country for building above the surface of the ground, we are strongly inclined to the belief that a fair and workmanlike attempt has never been made under judicious superintendence to apply a good hydraulic lime to this purpose. It is indispensable, in constructions of this kind, that the lime should possess some degree of hydraulicity, in order that it may harden before the injurious action of frost comes upon it. It is generally admitted, that mortar which contains no hydraulic principle, that is, mortar made from pure, or as they are technically called, fat limes, require a very long time to set perfectly hard; and it has even been asserted by experimentalists, who are well worthy of credit, that mortar has been found in a soft pasty state several years after it had been used in a building. On the other hand, hydraulic lime will harden in a very short time—requiring, in fact, a period which varies inversely with the strength of its hydraulic principle, this period, in the case of Roman cement, the most hydraulic of all mortars, seldom exceeding a few hours. The readiness with which concrete, composed of strong hydraulic lime, is found to set, confers peculiar value on béton for building purposes, because when once hardened, it is no longer subject to be affected by atmospheric changes, and may safely defy the influence of rain, moisture, frost, and the other destructive means by which imperfectly hardened mortar is so speedily destroyed.

As we have no wish to disguise or conceal what may be called the unfavourable side of this question, it may be as well to refer in this place to the opinions expressed by Lieutenant Denison and other officers of engineers, upon the use of concrete for building purposes. The opinions of these gentlemen are hostile to the employment of concrete, and are founded upon experiments and observations made upon concrete walls at Woolwich and some other places. Now we are perfectly ready to give every possible credit to the officers of engineers, for the care with which these experiments were made, and the fidelity with which these results have been recorded. We believe them also to have been free from any prejudice against concrete in the first instance; but granting all this, we are greatly mistaken if they have made use of the right material. Their experiments appear to have been made upon a simple concrete instead of a true béton, and owing to the long time which the former requires to harden in this climate, it was found to have been dissolved by water, and to have been shattered by frost before it had been allowed time to set. When we look at the undoubted fact, that constructions of béton have actually been practised in France with great success, within the last few years, there are only two ways of reconciling the anomaly which their reputed failure in this country appears to exhibit. Either the experiments have not been made with proper care and with good faith, or they have been made upon the wrong substance. At once, without a moment's hesitation, we reject the former supposition, and decide that the latter must have been the case.

In order that no doubt may remain on the minds of the sceptical with respect to the perfect success which has attended the use of béton for actual building in France, and at the same time to convey some knowledge of the process and style of building adopted, we shall here lay before our readers some particulars of a dwelling house lately constructed entirely of béton, by M. Jean Auguste Lebrun, upon his estate at Marsac near Albi, in the department of Tarn. This building consists of three stories, with three rooms in each floor, and a large granary or garret at the top. Along the front of the house extends a gallery which has a height equal to that of the building itself. Not only are the walls of this house composed of béton, but each floor is supported upon arches of béton thrown across from one wall to the other, so that throughout the whole building scarcely a particle of timber is made use of. The arches which support the first or principal floor have the following dimensions.

That for the gallery or passage, has a chord or span of 10 ft., a rise of 1 ft. and a thickness at the crown of 4½ in. The three arches which support the three rooms of this floor are each 17 ft. 4 in. in span, with a rise of 3 ft. 3 in., and a thickness of 10 in. at the crown. The roof of the building is formed by two semicircular arches, one covering the granary already mentioned and the other covering the gallery. The principal of these arches has a span of 20 ft. 3 in., with a thickness of 10 in. at the springing and 6 in. at the crown. The smaller arch over the gallery is 10 ft. in diameter, with a thickness of 6 in. at the springing, and of only 3 in. at the crown.

The béton was generally composed in the following proportions—

One part of lime slacked by immersion;

One part and a half of pure sand;

And two parts of gravel or broken flints, from 3 to 5 in. in diameter, according to the thickness of the walls in which they were to be employed. Thus the largest stones were used for the thick exterior walls, those of smaller size for the large arches, and the smallest of all for minute arches and ornamental mouldings on the outside.

The béton was in the first place well mixed up by hand labour, and then thrown into a framework or encaissement in regular courses of 1 ft. in thickness. This encaisement was simply composed of a few uprights, to which were secured horizontal planks placed on edge one above the other at the proper distance apart, so that when removed, the béton filled in between them shall occupy the proper thickness required for the wall. This method of raising the walls in courses of about 12 in. deep, appears to have been practised by the ancients in building with béton. The system will be quite familiar to those of our readers who have even witnessed the building of mud or earthen walls, as practised at this day in the Lyonnois and other parts of France, in the eastern countries, and in a ruder form even in this country and in Ireland. The arches for supporting the floors were turned upon centres of the usual kind, and the exterior mouldings in front of the house consist of béton filled into moulds prepared to receive it. A thin layer of lime mortar was plastered over the exposed surfaces of the walls. This plastering was pointed to a sharp arris at all the exposed edges, and seemed to give to the whole structure an appearance of smoothness and regularity which could not be expected from the naked béton.

In the summer time the béton of one course was generally sufficiently set in six hours to admit of the next course being filled in, and about twelve hours were required in spring time. As each course was regularly completed throughout over the whole area of the walls, the part which had been first filled in was commonly set by the time the course was finished, so that no delay took place on the completion of the separate courses. The centres for the arches of the gallery were struck at the end of a month after its completion, and those of the large arches were removed at the end of two months and a half. It was found that after this interval the béton had acquired so much consistency as to produce no thrust upon the abutments.

The exterior surface of the front wall, and the outside of the great arch which forms the roof, were painted with several coats of oil paint. This was done as much for the purposes of decoration as to enable the surface to withstand more perfectly the rain and frosts of the succeeding winter. It was found afterwards, however, as far as durability was concerned, this precaution was unnecessary, for those parts which had not been covered with paint, perfectly resisted all the rigors of the most severe seasons.

Not only has M. Lebruce, the architect who constructed this building, declared its perfect condition, after the lapse of two years, but he has accompanied a report, which he addressed to the *Société d'Encouragement*, with certificates from the prefect of the department of Tarn and the sub-prefect of the arrondissement of Gaillac, both of which attest the perfect solidity of the building, and state that it presents all the appearance of stone. In order to try the strength of one of the arches supporting the principal floor, it was loaded three months after the centres were struck, with a mass of earth 10 feet in thickness, and extending over the whole top surface of the arch. The weight thus applied amounted to 1250 lb. per square foot, or about eight times as much as that which a floor supports when a room is full of people, and this weight was borne without the slightest injury to the arch.

The great economy of this method of building is highly important. It appears that the cost of the whole work was no more than 5*s.* 3*d.* per cubic yard, which is about one-third the price of brickwork in that part of France.

It may be necessary to explain that the process of slacking lime by immersion, which is mentioned in a former part of this description, is performed in the following manner. The lime stone, after being burnt, is taken from the kiln and placed in a pan in pieces from the size of a walnut to that of an egg. The pan is then plunged for a few seconds into water, and withdrawn as soon as the lime begins to emit heat. After this operation, the lime continues to heat and swell and falls at length into powder. It is placed in this state in chests or casks, where the heat being concentrated, and a great part of the moisture being condensed and not allowed to escape in steam, will be again taken in by the lime which is then more perfectly slacked than otherwise. If the lime is intended to be kept any time before being used, the chests or casks should be covered with straw and placed in a perfectly dry place entirely removed from any danger of being penetrated by any kind of moisture.

(To be continued.)

ARE SYNCHRONISM AND UNIFORMITY OF STYLE ESSENTIAL TO BEAUTY AND PROPRIETY IN ARCHITECTURE?

An Essay to which was not awarded the medal of the Institute.

By a Student.

The question whether synchronism and uniformity of style are essential to beauty and propriety in architecture, is so novel, that it might have been well had the Institute of British Architects accompanied their proposition by some definition of the terms in which it is conveyed—or at least set some limit to the sense in which they are to be understood.

Of all the arts and sciences, none has ever been, or must necessarily be, more strongly affected by the inexorable course of circumstances, than architecture. None has been found more essential to the civilized existence of mankind. None has contributed more to the comforts of the humble, to the grandeur of the mighty, or to the gratification of the refined perceptions of those blessed with taste. None has so perfectly attained the combination of the useful and the beautiful. Since architecture assumed the conditions of an art, human genius has been on the stretch in every period and in every community, to bend its capabilities to existing manners and circumstances, and to study the modifications dictated by climate, by religion, by the comparative progress of the sister arts, by the state of mechanical science, and the minor effects exercised by soil and the choice of materials.

That architecture, practised during a long succession of ages, and modified by these and many other influences, moral and physical, should have exhibited the most opposite extremes in style, seems a necessary condition of its existence as an art. If, therefore, by synchronism and uniformity is to be understood the strict adherence, at the present period and in the locality of Great Britain, to any style of architecture appropriate to any other period or any other locality, such a condition seems *primâ facie* not only *not* essential to beauty and propriety, but to be utterly incompatible with any state of architecture worthy to be dignified by the name of art. It may be asserted that no such principle has ever obtained in any recognized school of architecture, and its conception seems altogether due to the new light, (or darkness visible,) thrown upon architecture some fifty or sixty years since.

Widely as the styles of architecture, which the lapse of ages has spread over Europe, may differ from each other—numerous as may be the subordinate varieties to which the great divisions of style may have given rise—the elements of all will be found few and simple. The origin of the existing architecture of Europe, must be sought in the works of the Greeks. The inventive faculties, and the fine perceptions of that people, have produced the most perfect adaptation of the means afforded by architecture to the end upon which they were employed, that has ever existed, and more perfect than can ever exist again; because the objects to which their architecture was adapted were compatible with its simplest forms. Until other nations have the same objects to fulfil, they never can use the same simple means with equal propriety, nor consequently produce by them the union of usefulness and beauty in the same degree. The simplicity of Greek architecture, its *oneness*, (to use a phrase of the cockney poets,) is the element which not only forbids its reproduction synchronically, but defies the invention of its parallel. To the simple elements which the felicitous genius of the Greeks reduced to the conditions of an art, may be traced all the systems of architecture which have followed in succession. From the Greek to the Roman, from the Roman to the Romanesque, from thence to the Byzantine in one direction, and to the Arabesque in another, from the Byzantine to the later Romanesque, and from thence to the Gothic, from the Gothic again to the Italian Renaissance, and from thence to the classical Italian schools, and the French and English schools of the 17th century, are transitions familiar to every architect who has studied the history of his art. These are styles, every one of which, judged by the circumstances under which it arose, and the purposes to which it was applied, whether civil, military, or ecclesiastical, will bear the severest test by which architecture can be tried—the test of usefulness, propriety, and beauty, mutually dependant upon each other. But where among them is to be found what it is presumed the Institute mean by synchronism and uniformity of style? If the hypothesis be founded that Greek architecture owes its origin to the Egyptians, it is evident that it never could have existed at all had the Greeks been infected with such a principle.

After ages of prosperity, English architecture languished in the hands of the followers of Lord Burlington. To something analogous to this synchronism we may perhaps trace its decay, since the unmitigated imitations of Palladio by the Burlington school, ended by driving the public taste to take refuge from their insipidity in the frippery decorations of the Adams.

The publication of the discoveries of Athenian Stuart was hailed as the means of a thorough regeneration of architecture. Greek and Roman republicanism shortly after filled the mouths of the orators of Europe, and the simplicity of the Greek style carried with it a prejudice that it might be "*done cheap.*" Under these circumstances Greek architecture appealed forcibly to the vulgar. Those who really felt and appreciated its exquisite purity and refinement, unfortunately overlooked the fact, that those very qualities rendered it inflexible to the combinations necessary to adapt classical architecture to modern requisitions. The Romans knew better. When they adopted the orders of the Greeks, they modified them with consummate skill, to fit them for combination with the arch and with each other. The modern Greek school jumped to a different conclusion, as logical as the sentence which annihilated the Alexandrian library. Greek architecture, like the Koran, being perfection, nothing could be necessary or expedient which was not contained therein, and in this conclusion triumphed the principle of synchronism. A brilliant popularity could scarcely fail to attend a doctrine pointing out a royal road to architecture, rendering superfluous the tedious study of the theory, the philosophy, nay, the very grammar of the art, and conducting to the glory of a Callicrates or an Apollodorus, every possessor of a Stuart's Athens and a pair of compasses. Roman architecture was rejected as spurious—the Italian schools dismissed with contempt—Inigo Jones esteemed an ignoramus—Wren a bungler—Vanbrugh a barbarian—Burlington a humbug—Chambers an imbecile. They built no Greek! As reasonably may Burke or Canning be decried for not declaiming in Greek. The principle would place Chatham below the school-boy who spouts a Greek oration by rote—no inapt parallel to the architect who compounds his odds and ends out of Stuart's Athens (not forgetting the supplements) to eke out his ready made portico, and looks with disdain upon Vignola and Perrault. If we suppose the boy's oration to consist of unconnected words like nonsense verses, the similitude may run a little closer.

Had Greek architecture been studied in a Greek spirit, important advantages might have resulted from its revival, but it is by no means certain that its peculiar forms and character will ever permit it to be amalgamated into any such combinations as the Italians have effected with the Roman, the flexibility of which, as displayed in their hands, enabled it to become the universal style of modern Europe, (modified by each country according to its wants,) until the Greek mania superseded it in Great Britain. *Purity* has ever been the ultimatum insisted upon by the advocates of the Greek style; but if a Greek architect could rise from the dead he would scarcely admit the purity of Anglo-Greek architecture. To face a building with an *avant-corps* much below its height, for the sake of introducing a single order—to back a Greek Doric portico with two stories of windows—or to flank it with arches cut into segments, and shorn of their impost and archivolt, that if they are not Greek they may at least look like nothing else—to associate the most decorative modification of the Greek Ionic, with doors and windows mulcted of their architraves—to condemn pilasters as a Roman invention, and to range Greek antæ on a wall—to force into combination two or three crude imitations of Athenian buildings where one has been found unmanageable—our resuscitated Greek would surely not admit that either the letter or the spirit of his art had been followed in such treatment of it.

These observations on Greek architecture, in its modern acceptation, have been put forward, because it is to the introduction of this style that the principle now recognized by the Institute under the name of synchronism is chiefly due, and its failure most signally apparent—so much so, that the argument may be thought levelled at a by-gone subject of discussion. The error is not, however, so worn out, but that designs may still be seen for purifying St. Paul's, by elevating a couple of lanterns of Demosthenes at the west end—opinions still heard, that Blenheim might be improved by the infusion of a little Athenian detail—commiseration still bestowed on Sir Christopher Wren, for the limited intelligence upon architecture in his time. If these freaks of fancy be not so rife as they may have been at an earlier period of the present century, they have been replaced by others not more to the credit of British architecture, upon which there will be a few words to say presently. In the mean time, it may be observed, that if synchronism and uniformity of style be indeed essential to propriety and beauty, then have the architects of the world been in a long error of some three and twenty centuries. Admit the principle of synchronism, and architecture ought to have stood still since it attained perfection at Athens. The Coliseum, the Thermæ, the Basilicas, Santa Sophia, the Alhambra, the churches of Amiens and Salisbury, the Vatican, the Palazzo Farnese, the Louvre, and a few other works by a few other architects, to which and to whom the world in general, down to the ultra-enlightened period of modern Greek, have agreed to allow some meed of praise, must all be denounced as worthless, should synchronism be essential to beauty and propriety, since they have all arisen from the perpetual state of transition of the art. What aberration from synchronism and uniformity is to be tolerated for the purpose of forming new styles? Where is the line to be drawn by which different styles ought to have been set apart as worthy to afford a new starting point for synchronous treatment, or where are they to be separated for the future? Or are the architects of the present day alone to be limited to the servile imitation of styles gone before, and their whole intelligence limited to treating them synchronously, excluding invention and the study of character and fitness as beyond their comprehension? What style is to be selected as best fitted to our exigencies—or are we to set up here a bit of Greek, there a bit of Italian, Arabesque in this place, Cinquecento in that, Gothic or Egyptian in another, to show how perfectly we have studied synchronism and nothing else! Forbid it ye sacred muses! and forbid the Institute of British Architects to entertain questions which expose them to the eyes of all Europe as plagiarists and imitators *prepense!*

Of late years, our ancient national architecture has occupied much of our study, and the investigation of its transitions has done much to fix this said principle of synchronism upon our practice. It is a wretchedly narrow path which our architects have chosen, and it is to be hoped that it may widen as it is pursued. It has certainly expanded since a Gothic cloister of the 13th century was erected for a ball-room (at Belvoir castle.) This work is executed with a knowledge of style and detail, with an attention to synchronism in one word, which leaves nothing to be desired so far; and it is evident that the clerical amateur architect, who has to answer for this performance, was perfectly innocent of the knowledge that anything was to be desired beyond it. Let us hope that such an error may not infect our professional practice, and that we may not be too complaisant in yielding to the prejudices and prepossessions, which a march of ignorance, unparalleled in activity and impudence, is just now spreading through the land in the shape of "a little learning." Our Gothic architecture and the peculiar national modification of the Italian which succeeded it, have been extinguished upwards of two centuries. The reformation of the church in the first place, and the alteration in our habits and customs since the erection of the last of those domestic edifices which it is now the fashion to revive, point to the necessity of some modification of the architecture of the middle ages, both ecclesiastical and civil, not very consistent with the principle of synchronism and uniformity. This consideration leads to a question involving these principles in something like a dilemma.

How are we to dispose of the mixed style which forms the principal stock in trade of this revival as far as domestic architecture is concerned?

The remains of the habitable portions of our great castles, and of some few buildings of a more purely domestic character, show clearly that in the earlier period of our architectural history, little attention was paid to the internal fittings, which now constitute the necessary comfort of our mansions, even of the most moderate class. Bare walls and such inconveniences as attend grated windows and ill-closed doors, were the general lot of those who could not afford the luxury of tapestry. Wainscot linings were not unknown, but their use was certainly not common, and none of an early date have survived. By the time a demand for more habitable interiors became general, the Gothic style was on the wane, and we may be troubled to find an interior among our ancient mansions, fitted up in a manner approaching even the commonest exigences of the present day, in which the wood and plaster work does not bear another character, although the fabric itself may be very unexceptionable Gothic. How far this mixture was carried, and how far it presently affected the fabric, it is unnecessary here to explain—but it may be observed, that the first Italian architect whose works are still extant in England, exercised his discretion in some very important modifications of the style he imported. The works of John of Padua exhibit as genuine a specimen of the school of architecture to which he belonged, as will be found in Lombardy itself—but with this difference—he adopted the English window and the English chimney. It did not enter into the mind of this distinguished architect, to condemn his clients to darkness and damp, for the sake of following the arrangements expedient in his own climate—in other words, he did not think synchronism and uniformity of style necessary to beauty and propriety. The example set by John of Padua became the type of the architecture of Elizabeth and James I, and the question is, when we recognize this mixture as a distinct style, and follow it, as the fashion now is, do we not set synchronism and uniformity in direct opposition to each other?

Some modern examples there are, of interior fittings founded altogether upon Gothic forms, but certainly possessing nothing of the Gothic character. A plaster cornice bordering a flat plaster ceiling is not Gothic, however scrupulously the mouldings may be profiled or the foliage modelled—a sash window with its apparatus of folding shutters is not Gothic, however artfully its structure may be disguised —a door case with its architrave and cornice, rebated jamb linings and butt hinges, is not Gothic, though its head may be pointed, and most orthodox putty squeezes glued into the spandrils—and yet this sort of internal architecture has been coined, in preference to adopting what was considered an inconsistency, though practised boldly and successfully by our ancestors of the 16th century.

Perhaps we are held bound, when circumstances call upon us to work out an early style of Gothic, to make everything cold and comfortless for the sake of synchronism and uniformity. This position would undoubtedly solve the dilemma, and the architect would then only have to persuade the inhabitants of his dungeon to dress themselves in the ancient costume and cultivate their beards, to speak Norman French, pray in Latin, eat with their fingers, and drink ale out of leather black jacks for breakfast, in order to earn immortal glory as a restorer of the arts.

We may aptly conclude with the following observations of the late Allan Cunningham—

"We never can lawfully become heirs to the fame of men who wrought in other lands and died three thousand years ago. No poet will claim as much merit from translating Homer or Dante, though he should excel Cowper or Cary, as he would deem his due had he written a Fairy Queen or a Task—but your architectural copyist takes a much loftier view of himself—he imagines he has achieved something truly grand, when he has persuaded a prince or a peer to have a house, every pillar and architrave of which can be justified from antique example. This servile spirit disgraces the architecture of our country—Greece will never surrender to us the honour of her porticos, or Italy of her elevations, and there is the more reason that we should dwell on the memories of such men as Wykeham and Vanburgh, whose genius, whatever else we may say of it, has at least given us architecture that we can honestly call our own."

THE CHAPTER HOUSE OF SALISBURY CATHEDRAL.

Read before the Institute of British Architects.

By T. H. WYATT, Esq., Fellow.

MR. CHAIRMAN & GENTLEMEN—I have always felt that there are no subjects of communication which may be made more generally useful to our members, than observations on *points of questionable construction*, or *propriety of style and date*, occurring, as they frequently must, in our practice. The paper read at our last meeting by Mr. Granville, has strongly confirmed me in this belief; it was one which could not fail to interest and instruct all who heard it. Acting, then, on this strong conviction, I venture to lay before you the particulars of a case which will, I believe, well repay its consideration.

The Chapter House of Salisbury Cathedral having fallen into a neglected if not a dilapidated condition, and the Lord Bishop of that diocese, being desirous to take upon himself the restoration of this interesting building (and so far to assist the funds at the disposal of the chapter, already hardly sufficient for the mere repair of the Cathedral itself), did my partner and myself the honour to ask for a report as to its present condition, and advice as to its entire restoration.

My first step was to inform myself of the history of this portion of the Cathedral group, and I referred to a variety of works bearing on the subject, and to such records as existed in the Cathedral library, at all likely to assist in the inquiry; but the amount of information they furnish is very slight, the Cathedral itself usurping, in all of them, almost exclusive consideration. There is no record of the exact period when this room (if I may call it so) was built, or in whose bishoprick. It is supposed to have been commenced a few years after the completion of the Cathedral in 1258, and its design is attributed to Bishop Bridport, who died in 1262. Price, in his history, published in 1753, merely affirms, "that by several diligent searches into and careful inspections upon the nature of the work, I find that the Cloisters, Chapter House, and Monument Room, were not begun till the Cathedral was considerably advanced, because the stone-work is not bonded together, as it must have been had all been carried on together, though manifestly by the same architect." But by whomsoever built, it must have been, in its original state, "with its central clustered columns, its vaulted roof and ramified ribs, its light, large and lofty windows, all decorated with stained glass, its sculpture, and a floor paved with richly glazed tiles," perhaps the most beautiful room of its class in Europe; or as Gilpin says, "nothing in architecture being more pleasing." The only paper or notice relating to it which I can hear of amongst the Cathedral records, is the following quaint report made in 1691, by a Mr. Thomas Naish, clerk of the works to the fabric; with an estimate of the charge of bringing it into good repair. "And first to begin with what threatens the suddenest ruin! The Chapter House is an octagon of 68 feet diameter built with too slight abutments to support the thrust of the vaulting, the least space of time (the weight of the former being too little for the thrust of the latter) were not the springers of the vaulting braced together with 8 bars of iron united at the centre, and fixed in hooks at each angle, which hooks are gutted with lead to fix them to the wall; but by the thrust of the arching several of these hooks are drawn out of their first place, some six inches, some more, some less; by which means the vault is spread and hath rent the walls in several places 3 in. or 4 in. wide, and drawn the columns which standeth in the middle (being not more than 16 in. diameter) about 6 in. from its perpendicular, and by a small declension further, must in all likelihood fall to the ground. The roof is also decayed, *and thrusts the walls outwards and helps towards its ruin.* Some of the buttresses are decayed at foot, the stones being loose or scaled by frost. Part of the walls between the vaulting and roof is by some former wet (*qy.* rent?) so shattered that it scarce well supports the roof. The mullions of windows also are scaled by the rusting of the iron bars that are fixed in them, and some of the tracery work like to drop by the spreading of the walls.

"The cure proposed is, a brace of iron round each buttress, fixed to the bars which now are in the crooks, which need be 3 in. broad and 1 in. thick, and will weigh the whole eight, 2160 lb. at 6*d*. per lb. amounts to 54*l*.

"An iron band quite round the Chapter House on the top of the windows, of the same dimensions, will weigh 2500 lb. at 6*d*. per lb. = 62*l*. 10*s*.

"Repairing the defective part of the timber work of roof, 40*l*.

"Repairing the walls between the vaulting and roof, new footing the butments where decayed! Restoring the mullions that are scaled and broken, and new pointing and keying of the walls and vaulting where rent, and all mason's work, 90*l*. Total 246*l*. 10."

So much for the only official document existing! The only portions of restoration which I can give Mr. Naish credit for having carried out, are as follows:

1st. Rendering the iron ties more effective than they could have been when merely gutted in (although not done as he proposed).

2nd. Certain repairs to the feet of buttresses. Of all his other grounds of lamentation, I see no proof that they were attended to. The iron band round the head of the windows was never introduced. The defective parts of roof, of walling between the roof and the vaulting, and the tracery of the windows may have been repaired, but certainly not in a manner to do credit to Mr. Naish's constructive powers. I am at a loss to reconcile his assertion, "that without the eight iron ties, the vault could not stand *the least space of time*," with the current report that Sir Christopher Wren introduced these ties; seeing that the building must have been completed 400 years before Sir Christopher reported in 1669. How far it is probable that the author or authors of this beautiful design would have introduced so clumsy a means of support, (even if they had subsequently imagined their abutment weak) when they had under their eyes the "magic flying buttress" so lavishly used in the Cathedral, I leave the admirers of Gothic architecture to determine. In Sir Christopher Wren's report on the Cathedral and spire, there is not a word as to the Chapter House; an omission not very probable if he had felt it necessary to have recourse to such a remedy. They were probably introduced at a period previous to his, and consequently to Mr. Naish's report, when either the present injurious roof (or the high pitched one which I doubt not originally existed) may have exercised a far more dangerous effect in the central column than any thrust from the groin. I will now proceed to describe the state in which I have found this building.

The present roof is a flat one, rising to the level of the parapet, as at Wells and as at Lincoln (previous to 1800, when the high pitched roof was restored). It is covered with heavy lead, by no means in a weather-tight condition. The construction of the roof is of the most primitive order, and has exercised a very injurious effect on the walls and on the centre pillar. Its general effect is very much like that of an open umbrella. From the solid spandril on the centre column rises a heavy octagonal post of oak, 16 in. diameter and 17 or 18 ft. high, morticed into which are eight heavy beams about 12 in. square, taking their other bearing on the solid wall over the buttresses. These beams, which are 33 ft. long, are supported by bent braces of all sorts of form and substance. The outer ones, which spring from corbels very low down, and only just over the spandril of the groin, have rent the wall in some places, and have occasioned a considerable outward thrust. These braces have become twisted and decayed; some of them have got out of bearing, and have allowed the strain on the centre pillar to become most irregular. The space between these eight main beams which I have described, is filled with seven heavy timbers 12 in. by 8 in. most injudiciously applied, the outer ends bearing on a heavy plate about 4 ft. above the point of the window, the thrust from which has much shaken the wall and injured the tracery of the windows; the other ends are wedged and skew nailed into principal binders. Nothing can be more injudicious than this construction; instead of throwing the weight of all these timbers on to the eight main beams, and so weighting the abutments, their load is thrown on the weakest part of the enclosing walls. The timbers are of oak and Baltic fir, indiscriminately mixed, and are generally in a pretty sound state.

The buttresses, which are of solid Chillmarke stone, are perfectly sound, and show hardly any symptom of decay or settlement; the intermediate walling is not so free from injury, the spaces below the windows showing indications of unequal settlement, from the greater mass and weight of the buttresses. The tracery of the windows is very much shaken, and the mullions have suffered considerably from the action of the weather and the corrosion of the iron bars. Internally the masonry is much injured, the exquisitely sculptured capitals, and the interesting series of scripture subjects commemorative of the life of Joseph having been shamefully mutilated by the Parliamentary Commissioners and their satellites, who quartered men and horses in these sacred buildings. The walls and niches bear evidence of having been highly decorated with colour and gilding, and there is still a strongly coloured ornament diverging from the bosses at the junction of the ribs. The stone seat running round the Chapter House originally occupied by the members of that body, is in a damp and perishing condition. The encaustic tile paving which covers the whole space of the floor is in a very unsatisfactory state, the colour much faded, and where the concrete foundation is carried round the walls, andthe central pier does not extend, it has sunk considerably below the original level. The windows have, alas, long lost the rich and glowing colours which, little doubt, originally added to the beauty of this exquisite room; the last remaining one having been taken down subsequent to Mr. Britton's survey in 1812. Although of the frailer material, wood, the old Chapter table (a most interesting relic) exists with less apparent injury and decay than even the walls which enclose it. The Purbeck shafts and capitals in the interior are, curiously enough, more decayed than the Chillmarke stone ones.

The centre shaft, of Purbeck marble 1 ft. 6 in. diameter, surrounded with its eight smaller ones, $4\frac{1}{2}$ in. diameter, from which springs the groin enclosing the room, is still in good preservation, though it has been thrust out of the perpendicular an extreme distance of $4\frac{3}{8}$ in. to the east. The smaller shafts have perished considerably, and will require to be replaced with new stone. The simple groin which springs from this shaft has its ribs of Chillmarke stone, 2 ft. deep, and about 12 in. wide: the intermediate groin being of chalk, 1 ft. thick, in the upper surface of which is a coating of fine concrete or mortar, the underside being plastered, and the joints of the stone marked upon it. I believe I have nothing to add to the description of its present state, and I now pass to the consideration of its restoration.

The removal of the iron bars to which I have already alluded, and which have a very prejudicial effect on the appearance of this room, was the first point to which my attention was directed, and this has naturally involved a difficult and anxious consideration, resolving itself however into this one point: Whether the abutment now offered by the buttresses, with the additional power of resistance they will gain by the whole weight of the roof being thrown upon them, instead of being scattered over the whole enclosing walls, is sufficient to counteract the thrust of the groin itself; (for care will of course be taken that the new roof shall occasion no outward thrust). I was led to suppose that, in the Chapter Houses of similar form and construction to this one, as at York, Lincoln, Wells and Westminster, I might find precedent of some kind. The inquiry has confirmed me in my previous belief, that the one at Salisbury was the lightest in construction of this class. At York, the groining to the Chapter House is not less deceptive than that to the nave and choir of the Cathedral itself, being of wood, in one span, of 57 ft. diameter. Till lately, it was enriched with painting and gilding; it has, unfortunately, of late years, been much injured by that worst vice in architecture, being made to assume the appearance of a material it really is not. It has been plastered and jointed and coloured in imitation of stone. With a sort of prophetic dread of the march of desecration, the Rev. John Drake, one of the Prebendaries, presented a view in 1736, "lest time or other cause should destroy or deface this magnificent structure." The roof, which seems to be of very strange construction, almost without any attempt at the principle of continuous trussing, has at least the redeeming virtue of being held together by the tie beams. I have been unable to get an accurate section of this building, which, however, is not of much consequence, as it bears so little on the object of my inquiry. This Chapter House, which, I believe, was built in the early part of the 13th century, would probably have been a few years anterior to the Salisbury one. The child certainly was not unworthy of the parent. The Chapter House at Lincoln is not much more useful to me, the excess of strength in this case being more puzzling. The groin itself could never have required such buttresses, and we can only imagine that the original roof must have been constructed with some considerable degree of thrust, against which these immense flying buttresses were brought into play. The present high pitched roof, which was restored in 1800 (one of low pitch having usurped the place of its original one) must, if correct, occasion a considerable thrust. This Chapter House is a decagon of 60 ft. diameter, and is supposed to have been the first built in this country of polygonal form, a variation from the square and oblong, as at Bristol, Glos'ter, Durham, and Peterboro', supposed to have been suggested by the circular churches of the Knights Templars. The Temple Church being dedicated in 1185, being 15 years before the completion of the Lincoln Chapter House, Giraldus Cambriensis attributing it to Bishop Hugh, who died in 1200. It undoubtedly must be considered a very perfect work for so early an era. "St. Hugh was a native of Burgundy, and may have obtained artists or designs from his own country." That of Wells is an octagon of 57 ft. diameter, resting on a groined crypt, Its height is considerably less than that of Salisbury, but like it, the groin springs from a central column 3 ft. diameter, surrounded by 16 smaller shafts, just doubling the size of the centre shaft, and the number of smaller ones at Salisbury. At first sight, the great disproportion between the abutments of this Chapter House and that at Salisbury, seems unaccountable; but on referring to the plan of the groining, it will be found that this of Wells is much more elaborately groined, and that the proportion of the stone ribs is as 9 to 3, 9 ribs springing from each buttress at Wells, 3 from each at Salisbury, naturally adding considerably to the weight and thrust even if the intervening groin was not heavier. I am not aware of the material used for this purpose. I believe chalk is not a material found in that part of Somersetshire: it is in all probability of stone instead of the lighter material. And in these causes, I think, the apparent discrepancy between the abutments at Wells and Salisbury may be satisfactorily accounted for. I do not know the exact date of the building. In feature and general detail it is of the same century as those I have alluded to; although in all probability it is subsequent to them. Whether it has gained in effect by reduced height and lightness, I must leave to others to determine.

The Chapter House at Westminster, the last I shall speak of, is of octangular form, and was a "remarkable instance of lightness and richness of ornament." It was built in the reign of Henry III, probably about 1250. As at Wells there is a crypt, the groining of which is of excellent workmanship. I believe that this building, in its original form, must have more closely resembled the Salisbury one than any of those I have referred to; apparently of similar height and width, its groin was originally supported by a central shaft having eight smaller shafts surrounding it. The walls are not of greater thickness than those at Salisbury; and the projection of the buttresses (where the flying buttress was not introduced) is as nearly as possible the same as at Salisbury. These apply to those on the north-east, north-west, and two to the west, where the cloister joins it. What the character of the original stone groining was, I believe there is no history remaining. Nor is it known exactly how long the monks held it, but in 1377 the Parliament held their sittings there, the crown having undertaken its repairs (well fulfilled) and it was so used till 1547, when Edward VI gave St. Stephen's Chapel for this purpose. It was then occupied as a place of deposit for exchequer records. On the 4th March, 1705, the House of Lords memorialized the Queen (Anne) to have it put into repair, and this is stated to have been done soon afterwards by Sir Christopher Wren, though I know not where are the existing traces of such repair.

The springer of the groin still remains over the central shaft, and the boarded floor rests on the old encaustic tile.

With the exception of this last instance, my consideration of the polygonal Chapter Houses has led to little satisfactory result; and if it were not that I fancy there is to be traced in each, good cause for the variations we find, I might become a convert to Mr. Gwilt's belief: "That the investigation of the equilibrium of arches by the laws of statics, does not appear to have at all entered into the thoughts of the ancient architects; experience, imitation, and a sort of mechanical intuition, seem to have been their guides. They appear to have preferred positive solidity to nice balance: nor have they left us precept or clue to ascertain by what means they reached such heights of skill as their works exhibit." I think if Mr. Gwilt had remembered the Chapter Houses of Westminster and Salisbury, he would have made them exceptions to his rule, and have allowed that at least they have worked as close to "nice balance" as in these examples they could well do.

Having failed, then, to discover, in these works of similar form and coeval date, any positive rules which could be a guide in determining the question of sufficient abutment, I endeavoured to find, in the works of those who have written on the theory of arches, some actual rule which I could reduce to practise, applying to this case. In this search I have not been very successful. The works of Peyronnet, Rondelet, Gautier and other foreign writers on arches, apply generally to bridges and other forms of vaulting rather than to groining as practised by the early Gothic architects; and that their abutments would not apply in one case is not very surprising when it is remembered that "rib pointed vaulting," composed "*ex lapide et topho*," has invariably the actual rib thinner than the uniform thickness of the Roman vault; and that the panels of the groin (the principal part in superficial quantity) sometimes does not exceed one-ninth the rib in thickness. A reference to their sections shows how light is the construction of Lincoln and Salisbury Cathedral as compared with that of St. Paul's, so much vaunted for the mathematical science it is said to display. The naves of St. Paul and Lincoln are the same height and width; the piers of the towers are double the diameter of the shafts in the latter, and its continuous wall exceeds in thickness by one-half the wall and buttress of Lincoln. Nor have I found anything in the works of Ware, Hutton, Mosely, Gwilt and others, which actually bears on this case. In the work of Durand, an old French writer on arches, a curious problem is laid down to determine the abutment of an arch, which, if not based on the soundest laws of statics, is at least ingenious and plausible, adapting itself to every form of architecture; the French engineers, I am informed, rely upon it to a great degree. I was so pleased with its simplicity, that I determined to test it by an experiment on a large scale. Having to construct the clerestory wall of a church, which was 50 ft. high, to the wall plate, with semicircular arches springing from columns 2 ft. 3 in. diameter, at a height of 18 ft. 6 in. from the ground, and abutting against a pillar, (of the strength of which some doubts were entertained,) I had formed in brickwork, to a quarter the full size, an arch of this description, retaining only as an abutment the width which this problem gave. The arch was loaded (in proportion) to the full height of the 50 ft., and no deduction was made for the openings of the triforia or for the clerestory windows, which in the original, would much reduce the weight over the crown of the arch. This experiment was made in a foundation of very questionable nature; it was carried up in mortar, and the centres were struck within an hour or two of its completion. This arch stood perfectly, and until the period of its being taken down, some weeks afterwards showed no symptoms of weakness. Having more abutment than this problem called for, and taking into consideration the reduction of weight effected by the openings I have alluded to, the clerestory walls were completed, as originally intended, and stand perfectly. This, then, is the most theoretically practical rule I have found, and has confirmed me in the belief that the vault of this Chapter House, would stand perfectly with the abutment it has. It will be found that the width of the abutment, at the level of the springing, is in the case of Salisbury, about one-fourth the span of the groin itself. That at King's College Chapel, Cambridge, although of a much flatter and more thrusting arch, has the thickness of the abutment only 3¾ times the width of the arch.

Trinity Church, at Ely, has a stone vault of segmental form, which has the abutments only one-fifth of the span of the arch, that arch being of a very flat and thrusting form. Of these most complex theories of the arch, so seldom brought to bear on individual cases, and so seldom accordant, one is almost inclined to say with La Fontaine—

"Quand on l'ignore, ce n'est rien,
Quand on le sait, c'est peu de chose."

Unfortunately this discrepancy in theory extends itself to data given as the result of practice and actual experiment, and adds infinitely to the difficulty of arriving at anything like a satisfactory result in inquiries of this kind. As instances, I may state that Rondelet, a French writer of much celebrity, gives a force of 5000 lb. on the square inch, to crush a piece of oak, and upwards of 6000 lb. to crush fir; whereas Mr. George Rennie, in his elaborate and detailed experiments, found English oak to crush with 3860 lb. to the inch, and fir with 1928. The result of all experiments on wood, however, go to prove that the resistance increases in a much higher ratio than the mere area of the material.

Mr. Rennie found Portland stone to crush with 1284 lb. to the square inch. Messrs. Bramah, in their experiments in 1837, found 1020 lb. crush it; whilst a central stone shaft at Anjou Cathedral, which is considered a remarkable specimen of lightness, bears only 500 lb. to the square inch, though calculated by Mr. Gauthy to be equal to the resistance of 3470 lb. to the inch.

It is probable that few experiments were made actually on the same data, the stones are not of equal quality, the wood unequally seasoned; and when we remember that oak timber loses 30 per cent of its weight in seasoning, these differences are to some extent explained.

Believing that one sound practical opinion would avail more in this case than any theory, I have sought the opinion of those members of our profession, and of those of the engineers, in whose judgment on such points I have the greatest confidence, and they have without one exception confirmed my belief, that if the outward thrust of the roof is removed, these ties may be taken away. I had the benefit of the opinion of Captain Dennison, (Government Engineer at Woolwich,) who examined the whole building with me most carefully, and who fully concurs in this view of the question. We tested the upright lines of all the outer buttresses, and we found that with very little variation, they had all gone outwards, from the perpendicular, between 3½ and 4 in. to the springing line, even those immediately adjoining the staircase and cloister walls, where naturally the abutment is greatest; proving, as we think, that this must have been the effect of one uniform thrust, when the centres were first struck, and the whole groin took its bearing. We found the iron bars slack, hardly any of them being strongly in tension.

The centre pillar has gone over towards the east considerably, to the north-east 3⅜ in., to the east 4⅝ in., and to the south-east 3⅞ in., an injury we believed to have been much more caused by the irregular thrust of the heavy roof than by any action of a groin, which from its abutments having all equally decayed, must have been nearly "in equilibrio." The stone ribs show hardly any trace of the necessary contraction and expansion which must have taken place when this pillar went over; and the chalk groin shows no settlement that gives cause for alarm. Having then satisfied myself as far as possible of the practicability of removing these iron ties, we propose to shove up the centre column, these timbers having been brought to their bearing (the weight they have to carry being 115 tons). I propose to take down the present central shaft, with its eight surrounding ones, to plumb a perpendicular line from the centre of the octagonal stone above the capital, and from this centre to carry up, on the old foundation, the central pillar, making good, with Purbeck marble, such ones as may be found to have perished. This foundation is composed of concrete of the best description, and evidently laid before its reputed father, Sir R. Smirke, could have introduced it into this country. This effected, and the groin left to its proper bearing, (the iron ties still being untouched,) I propose to take off the present heavy roof, and in its place to substitute, as I strongly hope, the high pitched one, the feet of the principal rafters being laid into cast iron shoes, held together, or rather in their places by eight wrought iron tension rods, 1½ in. diameter, having an eye at the end nearest the centre, into which the suspension rod (thickened at its lower end to 3 in. diameter) would fall, and hold up the tension rods. This roof, if adopted, would render unnecessary the piece of timber now resting on the centre column. The sprandrils of the groin I propose to fill to the height shown by the red tint. That this was the original form of roof, I believe there can be little doubt, a view in which I have been confirmed by Mr. Pugin, who has carefully studied this Cathedral, and who speaks most confidently to the point; to suppose it otherwise, would be to imagine that in this building they had thrown overboard the vertical spirit of the Cathedral roof, and of all roofs of that size of which we have any trace. Having satisfied myself that the further perpendicular weight which would by this means be thrown on the buttresses, in addition to that of the groin, could have no crushing effect, the weight each buttress would have to carry being 62 tons, which distributed over the area of each, gives a weight of 59½ lb. to the square inch; whilst the capabilities of Chillmarke stone (taken at four-fifths the lowest given for Portland) would require 823 lb. to the inch to crush it. The centre shaft bears 1000 lb. to the square inch. Rondelet says "there can be no danger in making stone bear one-third the weight which would crush it;" it is therefore fair to suppose there can be none in giving it one-fourteenth; and in this calculation I have made no allowance for the increased tenacity afforded by an increase of superficies. This risk being avoided, the additional resistance thus afforded to the thrust of the groin by the weight above, would be considerable. Of the value of this heavy superstructure, Sir Christopher Wren was fully aware. In his report on Salisbury Cathedral, he says, "As for the vaults of the ailes, they are indeed supported on the outside by the buttresses, but inwardly they have no other stay but the pillars themselves, which as they are usually proportioned, if they stood alone without the weight above, could not resist the spreading of the ailes one minute."

Should, however, the Chapter (whose consent to any plan must be obtained) object to the high form of roof, and require the new one to retain the pitch of the present one, and not to rise above the parapet, their decision must be final, and in that case I should propose to adopt this roof, which though simple enough in its construction, has at least this advantage over its predecessor, that it causes no outward thrust.

In either case lead would form the covering. The roof being made perfect, and all defects in the external masonry having been made good, I propose gradually to loosen the nuts which are now attached to the iron ties, watching most carefully if any fresh thrust follows. Those bars I propose to re-introduce above the groin and immediately under the roof. They would form a perfect tie at this level, and if unluckily any accident or failing shall take place in the cast-iron shoes or tension rods of the roof truss, these bars would then come into play, and would prevent the effect of any lateral thrust. The internal stone work we hope gradually to restore. The stone seat and step running round the Chapter House will be taken up, cleaned and re-laid, making good with new stone. Under this seat, it is proposed to form a flue in brickwork, into which would be introduced from a stove, to be built under the stairs, a current of warm air, having vents through, and stone ornaments on each face of the octagon, thus keeping the building free from the damp which now disfigures it.

It is proposed to relay the whole floor (containing 236 yards) with encaustic tile paving, of similar design and colour to those now existing; and instead of their being laid on the earth as at present, which has tended to make the floor damp and irregular, I propose to have a thin bed of concrete made with water lime formed over the whole surface not occupied by the foundations.

The plastering to the soffit of the groin, which now exists, is in a defective state, cracked and discoloured. It will be repaired and recoloured; and as the chalk groin is of rude and irregular surface, it perhaps will be desirable to reline it as it now exists, restoring the present coloured ornaments which now diverge from the bosses.

I have now only to allude to the windows. It is years since the last window of stained glass existed in the Chapter House. It was then taken down and used in the restoration of some of the Cathedral windows. If there ever existed a building in which colour was an essential ingredient, it is this; and I have every confidence that if the restoration, to which I have already alluded, can be satisfactorily carried out, that it will not be a very distant period before these windows will be filled with glass, whose colours shall be not less rich and harmonious than those which originally decorated this interesting building.

IRON SHIPS.—"*The Iron Queen.*"—We find that iron, as a material for ship-building, is fast gaining ground. For steamers, iron has been a favourite for some time past; and there is not now one wooden steamer building at this port, while we observe there are two iron ones, of the first class, nearly completed, and, we understand, contracts are made for the building of three more. We are also now satisfied, that the only objection to sailing vessels of iron, namely, the getting foul during a foreign voyage, is completely removed,. This is proved by the result of two voyages of the *Iron Queen.* This barque, 350 tons register, left the river Tyne in February 1842, with 424 tons of coals for Havana; from thence she went to Mobile for a cargo of cotton for this port. She has now completed another voyage, from this port to Galveston, in Texas, carrying 300 tons of salt out, and a full cargo of cotton home. She has been in the Graving dock, where she was visited by many persons, and she is found not to have strained a single rivet, although she struck heavily on Galveston Bar. There is no appearance of corrosion, the red lead being fresh on the plates; and neither shells, barnacles, nor any foulness, was on her bottom. This desirable result is caused by the simple application of a compound of tallow, bright varnish, arsenic, and brimstone, which effectually destroys marine, vegetable, and animal substances. The *Iron Queen* was built by Messrs. John Vernon and Co., of Aberdeen, and has proved very creditable to their skill as builders. The surveyors for Lloyd's here are so well satisfied that there is no corrosion that they have classed her A. 1.—*Liverpool Albion.*

IMPROVEMENTS IN LIVERPOOL.

[The following observations by Mr. Rosson, were made upon a paper lately read at the Liverpool Polytechnic Society, by Mr. Holme, on the improvement of Liverpool; we regret that we have not been able to obtain Mr. Holme's paper.]

Mr. Rosson said, that in compliance with the invitation of their respected president, he rose to make some observations on the very interesting paper just read by Mr. Holme. Architecture had been one of his favorite private studies for the last twenty years, and he had often lamented, during that period, to see the little progress which this great commercial metropolis of the north-west of England has made in exhibiting good specimens of construction. This was the more remarkable, when the vast means of private individuals, and the funds placed at the disposal of the corporation, were taken into account. Reference had been made to the noble models of architecture left by the ancient Greeks, whose remains which had escaped destruction still excited the admiration of every traveller who looked upon them. The Parthenon, for instance. Let us inquire by what means that transcendant work of architectural genius was raised? Why, it was raised because Phidias, the prince of sculptors of antiquity, had a Pericles for a patron, and by the influence of the illustrious sculptor, Ictinus and Callicrates were employed as architects, though under the controul of Phidias. But, independently of the good fortune of the Athenians in having a Pericles to judge and guide them in the application of high art, the Greeks had a mode which he (Mr. R.) would strongly urge the people of Liverpool to adopt, now that public competition had become the rule to guide them in their choice of the artists who were to execute from time to time the works that were to adorn their great city. The practice among the ancient Greeks was to call upon a number of distinguished architects to send in designs by a certain day, and when they had all been exhibited, to leave to the artists themselves the choice of the one that was to bear away the palm. This was by giving each artist *two votes:* one in favour of *his own design,* and the other for the *one he thought the best* among the compositions of his rivals. The best of the whole always turned out to be the one approved by the majority of the *second votes,* as a reigning beauty, at a public ball, is always considered by every handsome girl in the room decidedly the handsomest present, *after herself.* (A laugh.) Thus the wisest of the people judged and appreciated artists, and artists themselves judged and appreciated each other, in the face of all Greece, assembled on great public festivals. And in modern times, a very remarkable instance of public justice occurred at Rome, in the pontificate of Benedict XIV. That distinguished pontiff invited a competition of designs for the improvement of the Piazza del Populo, in which our, then, young countryman, the late Mr. Harrison, of Chester, entered the lists. The judges selected a Roman design; against the decision the famous Piranesi protested. His holiness caused the drawings to be re-examined. The consequence was that the judgment was reversed, and young Harrison received the gold medal. He (Mr. R.) lamented to say that that distinguished architect, the greatest since the days of Wren and Gwynne, chose afterwards to bury his fine talents in the little obscure city of Chester, instead of settling in London, and correcting the bad taste of Soane, Nash, and others. When a resident in the Temple, he (Mr. R.) had joined with his hon. friend, the member for Scarborough, Sir Frederick Trench, in the efforts made about fifteen years ago to construct the Thames Quay. The society, however, they then formed, though under the immediate protection of his late Royal Highness the Duke of York, and, indirectly, under that of the crown itself, could not accomplish their great object, though aided by many distinguished noblemen, gentlemen, and merchants, and by "the unaffected grace," and elegance, and talents, and powerful patronage of the late all-accomplished Duchess of Rutland. They, however, managed to erect some good buildings, amongst which must be named Stafford House, in the Stable-yard of St. James's Palace, the finest nobleman's town residence in the empire. He (Mr. R.) was cognizant of every stone laid in the construction of that edifice. The staircase, the finest thing in London, was formed on the model of that of Versailles; and the house, with the recent additions of the present noble proprietor, the Duke of Sutherland, formed decidedly the finest private palace ever erected in England. Finding, however, that public taste was not ripe for the quay, they intermitted their labours, as he observed, fifteen years ago; but he was happy to say that they had resumed them recently, with every expectation that, with the aid of the government, and the awakened taste of the age, and the labours of his friend Charles Barry, at Westminster, on the new Houses of Parliament—all those combined, he thought, would at length enable them to achieve the object of all their vows, and give a new character to the banks of the noblest river in our domestic empire. At the period referred to, when they (the committee) were busily engaged in their efforts, and publishing drawings, of which they were very proud, and were gradually drawing the attention of the London public, the elder Mr. D'Israeli entered their council-chamber, and astounded them with the information that they could not establish any claim to originality—that he held in his hand a book that set at rest and put the extinguisher upon all their claims as *exclusive authors* of the grand schemes they were projecting. He (Mr. R.) had referred to a "great unknown" of the name of Gwynne. Had any gentleman present ever heard of his name? He dared say not; and yet Gwynne was one of the greatest architects that this or any other country had ever produced; the book Mr. D'Israeli brought was the work of that illustrious architect, called "*London and Westminster Improved,*" 1761 or 1763. Every public improvement that had been made in London or Westminster, during the last thirty years, was down in that book, with this especial difference, that Gwynne's designs are infinitely better, exhibited greater taste, elegance, judgment, imagination, and resources than the works actually carried into execution. For instance, a bridge was suggested in the very place where Waterloo Bridge now stands, under the name of "*George the Third's Bridge,*" with approaches on each side the Thames, infinitely finer than those erected. Regent-street appears under the name, I think, of "*Great George-street,*" with elevations much superior to those actually existing—the bold cornice, the stone balcony, the harmony of parts, the solidity, in fine, which all our streets want, were there to be found sketched, giving a new character to London as it then existed. But that great man, whose talents were appreciated by Edmund Burke, Dr. Johnson, and the great men of the Literary Club formed by the great lexicographer, had the misfortune to be born forty years too soon. The times were not germane to his labours; public taste, from want of education, was not ripe; and his work, which deserved immortality, and would have obtained it in a better age, fell, still-born, from the press. His name would almost have been lost, had it not been kept alive by a reference to him made by Boswell in his Life of Dr. Johnson. But to return to the improvements of our "dear native city," Liverpool—for, though not a city *in law,* she was a city *in fact,*—he (Mr. R.) entirely concurred with his friend Mr. Holme, in all the observations made in his very excellent lecture; but he must confess that when he came down to the bottom of South Castle-street, he was much disappointed and surprised to see him make a *back somerset,* as it were, and avoid all mention of the *New* Custom-house. He (Mr. R.) never looked upon that building but with sorrow and disappointment—sorrow, that that erection completed the destruction of the finest inner harbour formed by nature in the kingdom (and in this he was confirmed by the opinion of the greatest engineer now living, whose name was another name for science in civil engineering), and disappointment, that so noble an opportunity of displaying architectural genius had been thrown away, by the erection of a building whose composition was full of bad architectural grammar, and whose vastness and solidity alone relieved it from absolute contempt. It was faulty in composition and in position, and its bad material excited the amazement of every one who knew that the vigilant jealousy of government was generally exercised with reference to the materials wherewith every specimen of architecture, civil or naval, was constructed. Look (said Mr. R.) at the basements of the columns. No geologist, deserving the name, would consider such material *stone,* but rather a *conglomerate* of sandstone in its primitive formation, full of cracks, and threatening to fall to pieces: the columns in *ten pieces,* instead of *two.* The joints will be the first part of the building to decay: posterity will have to replace them sooner than the present generation imagine. Walking round, you may almost thrust your thumb into holes filled up with clay and rosin! Alas! all this arose from irresponsibility, and the absence of competition. It was a bad thing for the architect himself. His (Mr. R's.) friend, Charles Barry, competed with all the rising talent of Britain both for the Houses of Parliament and the Reform Club-house,—the finest private palace, for its purpose, perhaps in Europe. To return to the Custom-house. In point of composition—the utter want of distribution of light in the rooms and corridors produced a "darkness visible," which, independently of its perpetual inconvenience in a place where so prodigious an amount of business is transacted, gave the whole the appearance of the gloomy chambers leading to the catacombs of the dead. Indeed, said Mr. R., I have long denominated it "The Tomb" of the inner harbour of the port of Liverpool. Mr. R. proceeded to say,—"I speak this in sorrow; but just censure is the tax which all public servants must pay, especially that portion of them who have been largely endowed by the public press, and have not returned their money's worth in public service." But he would now turn to a more pleasing subject. He begged to congratulate the society on the prospects before them. Liverpool had at length obtained the aid of an architect, whose talents were of a high order. He had been recently introduced to him in London—was delighted with his designs, and pleased to find him so young a man. Liverpool had nothing, as yet, but her *docks* to exhibit to the stranger: those would pass muster with the greatest engineers. But they had now to look forward to the erection of a *Place* (as the French called it) that would form the capital of the city, containing a street and courts of justice of surpassing beauty. That would be the era from which posterity would date the commencement of an architectural style worthy of the second commercial city in the empire, and, consequently, in the world; and he felt justly proud, encouraged, and animated by the approaching triumph.

BLASTING OF THE ABBOT'S CLIFF AT DOVER.

Another of those remarkable engineering operations which have already attracted the public attention, in connexion with the South Eastern Railway, took place on Tuesday, April 18th, at a distance of about three miles to the westward of the town of Dover. In order to afford an outlet to the Abbot's Cliff Tunnel, and a platform on which the rail could be laid down between that and the Shakspeare tunnel, it became necessary to remove a portion of the projecting cliff. From the success that had attended former operations of the kind, and especially the recent blast at Rounddown Cliff, it was resolved to remove it by the aid of gunpowder.

The surface of the cliff acted upon by this explosion lay to the westward of the Rounddown Cliff, and its remaining cliff forms the face of the terminus of Abbot's Cliff tunnel. It extended 300 feet in length, and the height of that portion which was directly acted upon was 200 feet. The object of the operation was to slice off, as it were, a large portion of this surface, so as to make that which was before rugged and uneven, and which projected far too much in the way of the proposed line along the side of the cliff, perfectly flat and smooth, and fit to afford a sufficient platform for the road to be laid down upon, and to prepare the terminus of the tunnel. The "slice" to be removed varied in thickness, according to the extent to which the surface projected beyond that which would be convenient to the operations; at some points it was 60 feet, and at others 30 feet, and the quantity of powder introduced at the different parts was, therefore, proportioned to the thickness of cliff to be removed, regulated, of course, by the degree of resistance which, from the greater or less nearness of the surface to the chambers in which the powder was deposited, would be offered to the action of the powder. The quantity of powder in each chamber was calculated according to the line of least resistance. Cubing the line of least resistance, one-half the number of feet is the number of ounces of powder used. The arrangements made for the introduction of the powder and the simultaneous ignition (if possible) of the different charges were simple, and, at the same time, ingenious in the extreme. There were altogether 100 barrels of powder, or 10,000 lb. This quantity was distributed in various proportions in 15 different chambers, at nearly equal distances. To form these chambers the rock was perforated at those nearly equal distances, and the different proportions of powder were introduced on Saturday last, and "tamped up" close. There were two separate lines of these chambers of powder, and therefore two series of charges; one being near the top of the cliff, about 200 feet from the summit, the other about 100 feet lower down. Thus a space of about 150 feet from the bottom of the cliff remained altogether untouched by the explosion, that being required as a platform for the road to run upon at the entrance of the tunnel. The apparatus for igniting these different charges was placed to the eastward, about 2000 feet from the nearest, and about 500 feet from the furthest chamber. It consisted of six batteries of 20 plates each, and by an ingenious invention of Mr. Hodges, the assistant to Mr. Wright, the resident engineer of the line from Ashford to Dover, they were all fired simultaneously. Simple as the invention is, it is not so easy to describe it on paper. Suppose a triangular skeleton chair; what would be the seat of it is suspended by a common string at the distance of about an inch or more from a framework beneath (resting on the legs of the chair), in which are fixed the batteries and connecting wires. Immediately under the string which suspends the other portion of the battery is placed a circular trough, in which there is a "blue" light. Through this light is passed a fuse, 12 feet long, and taking some minutes to burn down. This fuse was fired by Mr. Hodges, who had time to get away from the spot before the string was burnt. The moment the string was severed by the flame, down went the upper framework, the voltaic action was performed, and the electric fluid communicated to the wires. These wires were two, one for the upper, the other for the lower range of chambers, each extending the whole length of the surface to be operated upon, and attached to them were other supplementary wires communicating with the chambers of powder. The ends of these additional wires were of course formed in the usual way, with a piece of platina wire affixed, which on being made red hot by the electric fluid ignited the gunpowder in what are called the bursting charges—small portions of powder in cases surrounding the ends of these wires, which again immediately fired the larger quantities of powder contained in the different chambers.

Thus within a few moments after the ignition of the blue light, the upper framework of the skeleton chair above described fell down, the voltaic action was completed, and in almost an equal period of time the explosion was effected. And yet how remote to all appearance the connection between the burning of a short piece of string (a foot long) and the fall of that immense mass of cliff!

The operations at the Rounddown cliff were carried on under the advice of General Pasley and Lieutenant Hutchinson, who also took a great interest in the proceedings on the present occasion; but the whole of the arrangements for the explosion of to-day were under the controul of Mr. Wright, the engineer, assisted by Mr. Hodges, as already mentioned. As far as the practical effect of the operation was concerned all was successful; but as a mere sight the affair was unfortunate, in consequence of the thick fog that hung over the cliff, and made it impossible to see the actual fall.

At 4 o'clock, the hour appointed for the blast, many thousand persons were collected to witness it, but the thick fog obscured all. I took a boat, and approached as near to the shore as was allowed, but could see no more than the crumbling mass falling down into the water beneath with a sound resembling the roar of artillery heard at a distance, and the noise of the surge breaking on the sea shore. In respect of the noise created, this explosion differed from that at the Rounddown Cliff. There no noise whatever was to be heard, or scarcely any, and the mass of rock glided almost silently into the sea like a mighty wave; but in the Abbot's Cliff blast there was much more noise, and it was more prolonged.

Those who were on the cliff were sensible of a shock a few moments before the detached portions of the cliff fell. Explosion is an inappropriate term to use; for, in fact, as far as hearing is concerned, there is nothing of the sort;—the operation of the powder is internal, and the effect only known by the fall of the fragments. Mr. Hodges, the assistant engineer, fired the fuse in connection with the battery. He had four minutes in which to get away, but had calculated that he could run down the ladder in two and a half. He was the last person who left the range of the batteries.

Beside the multitude of persons collected on the cliffs and on the adjacent shore, the sea was covered with boats of all sizes and shapes. There were also two large steam-boats filled with visitors.

Although in consequence of the thick fog or mist the spectators were deprived of much of the gratification which such a sight would have afforded, the operation, in a scientific point of view, was held to be decidedly successful. All the chambers of powder were ignited simultaneously (or nearly so), and the immense mass of disturbed chalk and earth fell slowly and equably into the sea. The exact results, however, cannot of course yet be ascertained.—*Times.*

ROYAL ACADEMY.

Professor Cockerell's Lectures on Architecture.

(From the Athenæum.)

Lecture VI, and last.

Proportion, and the application of its golden rules, as they affect the external forms of architecture, had occupied the latter part of the preceding lecture; the *αναλογια* of the Greeks, delivered to us by Vitruvius, that analogy, by which all the conformations of artificial bodies were derived from natural bodies, seemed to be a principle of obvious importance and utility to the architect, and should be attentively considered.

It appeared that the animal kingdom furnishes clearer lights for our guidance than the vegetable, because organized nature was more constant in her proportions, and enabled us always to re-establish the whole from a part; thus the hand of a Grecian statue, of the Hercules, the Apollo, or of the Venus, or a fragment of any one of the Grecian orders of architecture, enabled us to restore the whole; indeed, the proportion by aliquot parts by a modulus, a principle of the Greeks, as explained by Vitruvius, lib. i. c. 11, lib. iii, c. 1, was still practised in India, and seems founded in organized nature.

Not so in the productions of the vegetable kingdom, fragments of which would never enable us to comprehend the whole: however indebted to this part of the creation for the graces of ornament, and various essential analogies, architecture found a less sure guide of proportion in this than in the animal kingdom: in fact, all architecture so derived was anomalous, as the Egyptian and the Gothic, in which no fixed laws of proportion have ever been applied or attempted. Columns or supports might be from five to fifty diameters in height, and were only bounded by possibility. The stunted pollard, the spreading cedar of Lebanon, the aspiring poplar, or the attenuated cane, were extremes equally at the disposal of the architect.

But that guide, which the face of nature furnished to the architect for his external forms and proportions, was wanting for the internal—as of areas, squares, courts, and open places; or of internal capacities (height as well as area); as of temples, halls, apartments, &c.; in these we must appeal to the relations of reason, purpose, and convention.

Vitruvius (lib. vi. c. 2, 3, 4, 6, lib. v. c. 1, and c. 2.) gives us the experience of the ancients on this important subject. The Greek forum, says he was a square, but the Roman was three by two, because the gladiatorial shows were exhibited there; courts should have the proportions of five by three (the favourite of the learned Palladio), sometimes three by two, or sesquialteral, or the diagonal of the square will be the length. He lays down the proportions of all the apartments of the Greek and Roman house: atria, alæ, tablinium, and peristylium, triclinia, œci, exedræ et pinacothecæ. He does not, however, establish any *principle*, and his rules are wholly empirical. But the great Alberti, not content without a principle, adopts the Pythagorean doctrine of universal harmony, and agreement between sounds and numbers, namely, that what pleases the ear pleases also the eye; he lays down, therefore, his harmonic proportion, in which Blondel, Ouvrard and others have followed. The notion of musical proportions is common, and has occupied many ingenious minds already versed in that art. Describing St. Peter's, Byron, in this feeling, observes

> Vastness which grows, but grows to *harmonize*,
> All *musical* in its immensities.

Alberti was the first also to establish the rules of arithmetical and geometrical proportions (lib. ix. b. 3, 4, 5, 6), applied to all the varieties of areas and capacities. He is followed by Palladio in the arithmetical and geometrical rules, lib. i. c. 23.

It is a comfortable conclusion to the practical architect that the empirical rules of Vitruvius, the harmonic, the geometrical and arithmetical rules of Alberti and his followers, agree in the main, so that either may be adopted without material deviation from correctness; but the neglect of these rules, in which lie that hidden charm that every one must be sensible of when examining a finely proportioned room, has been common of late years, as if the principle were of no value; the zealous student therefore should carefully note that consent of the ancients and the most illustrious masters of the moderns, here set forth; and he will soon learn devoutly to repeat the denunciation of the Hindu Vitruvius (Ram Raz, Asiatic Society, 1834, p. 15), "Woe to them who dwell in a house not built according to the proportions of symmetry."

It is true, that the climate of this country and our habits do not often permit the finer Italian proportions; thus the arithmetical rule of proportion, common with our greatest masters, in our best mansions, 36 by 24, should give us 30 feet high to the vault, but we commonly limit it to 18 feet. To correct the defect of lowness, so frequent with us, the illusions of perspective painting, after the admirable Pozzo, may well apply; but even the arrangement of the trabeation and plaster enrichments, offer to the ingenious architect, versed in perspective, many resources for the increase of the apparent height, and for the attainment of an artificial proportion. But a manufacturing people are prone to carpets, rugs, curtains, gilded frames, and mahogany furniture, while the low ceiling is a sheet of paper stretched like a drum, at most of a neutral tint, of indurated fog, with a gilt moulding: while the artistic Italian opens a window of perspective in his ceiling, through which a canopy of poetry and distance delights the eye, and deceives the understanding; but the floor is paved with tiles.

Again, in our modern churches, a ceiling, 60 by 80, has often been fearlessly stretched in one unbroken surface of plaster, in defiance of the fine examples of Charles's and Queen Anne's churches, in which a cove, after the Italian manner, has the effect of reducing the ceiling, and of rectifying the proportion in the simplest and most graceful manner. The student should well reflect on this important field for architectural skill and effect. He may be a good builder and cheap, but he can have no pretensions as an artist who throws away his time and his character in such condescensions as this mechanical employment of his talent implies.

The rules hitherto referred to, have the beautiful for their object. Beauty in architecture depends, amongst other causes, especially on the exact and graceful proportions of the parts and of the whole. But the sublime depends upon other causes, in which rules cannot prescribe; to the latter not only the rules of the former do not apply, but they are destructive of it. If the beautiful resides in the proportionate, it would appear that the sublime often resides in the disproportionate. The principles and the rules of beauty and sublimity are distinct. If we stand under an arch of London Bridge, the vaulted soffite, so vast and extended, sustained from such distant abutments, produces a kind of sublime; no doubt aided by its comparative lowness. The Pantheon is inscribed in a cube, its height equal to its diameter; no one standing under its prodigious cupola has ever denied its sublimity. But when that same Pantheon is raised into the air (in equal dimension) at St. Peter's, it may have become beautiful, but has lost its quality of sublime. When Byron apostrophizes the Pantheon, he feels the peculiarity of its merit:—

> Simple, erect, severe, austere, sublime,
> Shrine of all saints, and temple of all gods,
> From Jove to Jesus, spared and blest by Time,
> Looking tranquility!

As the dome of the Pantheon is raised at St. Peter's into a proportionate height, at the expense of its sublime, so the nave (nearly twice as wide as that of St. Paul's Cathedral), also raised proportionately, loses all effect of magnitude; and the common and universal observation is, that as respects this important effect the architect has laboured in vain; and the work stands self-condemned.

The noble poet coincides with the received opinion, and is obliged to supply by poetical moonshine that dignity and interest which it was his object to give to the Vatican. He says—

> Enter, its grandeur overwhelms you not,
> And why? it is not lessened; but thy mind,
> Expanded by the genius of the spot,
> Has grown colossal; and can only find
> A fit abode wherein appear enshrined,
> Thy hopes of immortality!

Sometimes this failure has been attributed to its proportion, which (from its justness, it is said) takes from its magnitude; a criticism at once the most severe and just that can be. In fact, no increase of a proportionate object will ever give it magnitude and the sublime; these depend on extraordinary relation and excess of parts and proportions.

Some years ago a French giant, upwards of nine feet high, exhibited himself in London, but so just were his proportions that no one would give credit to his dimension, till they stood beside him; he was therefore accounted a kind of fraud, and the exhibition failed. But had he been disproportioned, his head small, his shoulders high, and his members excessive, he might have succeeded, even had he been a foot shorter. Had the nave of St. Peter's, 77 feet wide, been 90 feet high only, instead of 145; or if we were to suppose a stage raised mid-height and place ourselves upon it, we should be sensible of its vast latitude, and the effect of magnitude would have been produced as under a bridge. The Barriere de l'Etoile, from the same reasons, though as large as the front of Notre Dame—the arch itself 48 by 95, equal to the height of the nave, but of ordinary proportions and great simplicity of parts and members—loses its effect: the *arc monstre* is glorious to the *grande armée*, but not to the arts of their day; and is infinitely less artificial in its combination that the arches of St. Martin and St. Antoine, designed by the accomplished Blondel.

If, then, the architect can obtain latitude, he should seek to carry out its effect by quadrate and comparatively low proportions; but if he adds altitude to his latitude, he loses his expense and pains, and he may find too late that half his dimension might have attained the same effect; since *proportionate magnitude* defeats itself.

But as extreme latitude gives the sublime, so does its opposite extreme of altitude: in Cologne and Beauvais, the naves of which are three and a half diameters in height, though scarcely more than half the actual width of St. Peter's nave—limited, therefore, in their dimension to the usual cathedral width, yet nearly double the usual proportion—the sublime is completely attained; and disproportion again appears to be the efficient cause.

But the optical consideration of the visual angle in which these several proportions present themselves is exceedingly important. Thus to the spectator of the dome of the Pantheon, the visual angle is 95°, while the same dome raised into the air at St. Peter's is only 30°. In the nave of St. Peter's, the visual angle is 48°, that of St. Paul's Cathedral is 37°, while the vault of Cologne is only 22°. Since then the effect of magnitude is measured by the number of degrees in the visual angle, the architect will advert to this consideration as of extreme interest.

We come, then, to the important conclusion, that the sublime and the beautiful are to be found in the proper adjustment of proportions, rather than in dimensions; and we may infer, that no increase of scale to the beautiful will ever make it the sublime.

But the sublime is of rare occurrence: the use, however, to which these reflections may be turned by the practical architect, under limited means, is remarkably illustrated in the Casino at Chiswick, where the very circumscribed area of the rooms is compensated by their extraordinary height, and the accomplished Lord Burlington has given a nobility to very small apartments which no one could believe on seeing the plan alone, without visiting that elegant work.

Magnitude is the great object and result of design, and this quality is only to be attained by the fine adjustment of relative proportions in magnitude and order. Architecture consists in magnitude and order (says Aristotle), το γαρ καλον εν μεγεθει και ταξει εστι. (Poet. p. xi. s. 4.) The works of man, compared with those of nature, display our insignificance. The pyramids, seen in the clear sky of Egypt, or St. Peter's at Rome, are proverbially disappointing to the first gaze of the beholder: it is only after he has instituted comparisons and admeasurements that he becomes sensible of the greatness of these human efforts—and his memory will supply him with many instances in which objects of very inferior dimensions have surpassed them in impression of magnitude upon his mind. It is plain, therefore, that art alone can produce the full effect of magnitude, and to this the architect should direct all his skill: the ancients will be found consummate masters in this as well as in every other department of our art. It is, indeed, a fine art which enables the accomplished artist to raise ideas of magnitude and grandeur of composition on a piece of paper no bigger than your hand; while a less able one shall cover a vast canvas without executing any comparable notions. Worthy of all inquiry and solicitude is such an art, for it is the whole art of design and proportion. Pliny cites a statue of Hercules, so small that it might be lifted by the hand, which, however, conveyed more grandeur, magnitude, and strength to the mind of the observer, than a Colossus would have done. How great must have been the science of the master! and if, with such small means, he could affect the mind with these impressions, how great the economy of cost and material to the employer!

Burke, whose notions, however, of proportion are vague and erroneous, says admirably on this point (sec. x.)—"A true artist should put a generous deceit on the spectators, and effect the noblest designs by easy methods. Designs which are vast only by their dimensions, are always the sign of a common and low imagination."

In the last lecture it was attempted to show that magnitude, breadth, and proportion of parts were best found in inequalities; but the consideration of magnitude, as respects composition of the whole, seems to depend on other principles: first, it appears that, to make a great whole, there must be many parts; secondly, to appreciate that whole, the point from which it is permitted to be seen should be eusynoptic, namely, so contrived as to fill the angle of vision of 45·0, and occupy the whole retina with multiplied impressions fairly and agreeably presented.

With reference to the first proposition, it may be observed, that in a young tree bursting from the ground, two or three branches with upward tendency grow from the polished bark; the subdivisions are few, and we may count the leaves. By and bye, with age and maturity, the bark becomes rough and corrugated, the base is surrounded with excrescences and roots, which, partly above the ground, indicate the hold it has on all the surrounding space; the branches now shoot out at right angles with the bulky stem, each limb becomes a tree, the subdivisions of these are infinite, and, in all degrees of size and proportion, the leaves are countless. So the young animal, simple in parts, and smooth, expanding with age and strength, develops features and subordinate parts never dreamt of before; furnished and complete, the measure and fullness of strength and beauty is at length filled up. So in architecture, the tetra-style portico can never look large, though, in St. Peter's, the columns have eight feet in diameter. The Hecatompedon, burnt by the Persians, was not inferior in the scale of its parts to the present Parthenon, but Ictinus judged that, by increasing the number of parts—making that octo-style which had been hexa-style only—greater magnificence would result.

The temple of the giants, at Agrigentum (hepta-style) was the largest Doric of antiquity, but to give it all its value, a number of new features, never seen before, accompany its increased growth and vastness. It is raised on a platform of many steps, a base of novel design surrounds the colmuns, and these vast masses themselves, each a tower of thirteen feet in diameter, built of many stones, told by its many parts and its elaborate construction the cost and grandeur of the undertaking. So the columns at Pœstum have twenty-four instead of the usual twenty flutings; in short, examples are infinite to show that, to convey the full effect of real magnitude, an artificial magnitude must be superadded, or it is lost labour.

Gradation and repetition of features of the same general resemblance in various sizes, the major and the minor, are main sources of magnitude; the artist will see, in the satellites surrounding the planet Jupiter, the best reason for the title of the Father of the Gods; the western towers of St. Paul's give magnitude to the dome. The same principle was to have been applied to St. Peter's, but the western towers fell down. In the admirable church of the Salute at Venice, the minor dome over the high altar, and again the still smaller towers accompanying this, are foils to the great dome. Byron admirably enforces the number of parts :—

"Thou seest not all; but piecemeal thou must break,
To separate contemplation the great whole;
And as the ocean many bays will make,
That ask the eye—so here condense thy soul
To more immediate objects, and controul
Thy thoughts, until thy mind hath got by heart
Its eloquent proportions, and unroll
In mighty graduations, part by part,
The glory which at once upon thee did not dart."

Childe Harold, c. iv, v. 157.

So Palladio (as already remarked) characterized his style by the interpenetration of the larger order by a smaller.

In decoration we are careful to put a small scroll in juxta-position to the larger, to give its full effect; and so the painter, to give size to his principal figures, interposes women and children in various gradations; the wreath or swag which shall contain flowers or fruit, all of the same size, will be mean, or look like a string of onions; the whole secret of proportion and whole purpose of magnificence is attained, by satellites, and by gradation of the major and the minor.

With reference to the second proposition, the consideration of the point of view of architectural works, the ancients, as has been already observed, were consummate masters, and cannot be too carefully studied. The labour of the architect is vain, if he miscalculates the point of view, and the picture which he is to present on the retina of the spectator. As well might the painter consent to a bad light for his work, as the architect be careless on this point. The *genius loci* will insist upon a peculiar composition; each position requires its own adaptation; we should have proper things in proper places. A design good in one place may fail in another, and the unskilful approach and point of view may ruin the best scheme. It is not enough to be right, but to show that you are so: the "*faire valoir*" is a fine economy which runs through the architecture of life, as well as of every step in brick and mortar. The architect must be well versed in this part of optics: the synoptic, the eusynoptic, the *deceptio visûs*, should be his constant observation; like a skilful general he must manage and manœuvre his masses to impose upon the spectator, and by their skilful disposition he may often gain that ascendancy which his real forces may not warrant. A familiar instance of this is seen at St. Paul's, and often practised upon the green-horn mason, who visits London for the first time. Of the two orders which decorate the exterior, the lower one forms the great order of the interior, in the same precise dimension; but the angle of view in the interior being so much larger, the spectator is persuaded of its larger dimension. The roguish cicerone engages the novice in dispute on this question, enforced by a bet, which on proof is always to his disadvantage and the penalty of his pot of beer.

Sometimes accident does more for us than wit. St. Paul's, constrained, and crowded amidst narrow streets, produces on the unsophisticated a magnitude and interest which would be lost if the pedants had their way, and large areas and terraces were to expose it from Farringdon Street and the Thames.

While considering magnitude, we must not forget that (the most difficult of all) which arises from greatness of conception—a quality which every one habituated to contemplate fine buildings, must often have been impressed with. But much more the ingenious architect, who in his practice has had opportunities of comparing his own design with those of others more able than himself, and still more in canvassing the various modes in which a work might be performed, will remark the difference between one mind and another. He will find all the moral qualities of the artist exhibited in his performance. "By their works ye shall know them;" greatness of soul, or contractedness of spirit, a folly or a vice, the specious, the clumsy, the refined, the honest, are written in characters quite legible to those who have learnt to decipher the language of design.

We might show the character of Wren in the lineaments of his work—sublime in his mathematical attainments, clear, original and comprehensive in his combinations above all men; but in his exterior unobtrusive and timid, small and elaborate, concealing the art (as Nature does) revealed only on our nearer examination to our wonder and delight. We plainly see "the Nestor of Athens, not only in his profession the greatest man of that age, but who had given more proof of it than any other man ever did; he was in a manner the inventor of the use of mechanical powers; and they record of him that he was so prodigiously exact, that, for experiment's sake, he built an edifice of great beauty, and seeming strength, but so contrived as to bear only its own weight—so that it fell with no other pressure than the settling of a *Wren!* But such was Nestor's modesty, that his art and skill were soon disregarded, for want of that manner with which men of the world support and assert the merit of their own performances: and for want of that natural freedom and audacity, necessary in the commerce of life, his personal modesty overthrew all his public actions."—Parentalia, p. 341.

In the works of Jones we see the beautiful and specious, the sensual beauty of the tasteful artist, but no mathematics, no sublime combinations of structure, but generous, and free, and highly ornamental, we discover the director of the masques of the splendid court of the Stuarts—the "Marquis Would-be."

In Vanbrugh we have the dramatist throughout; his theatre and scenery are everywhere, imposing with a pompous grandiose, the spectator is at first captivated, till he peeps behind the scene, and the illusion vanishes.

In short, it is plain that the architect must have moral as well as intellectual qualities, to acquit himself duly of the high charge intrusted to him; and no argument can more effectually convince the student, that in ordering his studies he must first order his own character and conduct; and that nothing can come from him of great and noble, unless from a pure fountain and a well-regulated stream. We must endeavour to sustain that rank in society which both sacred and classical antiquity have assigned to the architect (see Isaiah, c. iii. v. 1, 2, 3; and Cic. Off. p. 42.)

But an important principle in the æsthetical as well as in the real ends and purposes of our art is solidity, the result of equilibrium between the forces of gravity. Nothing can be beautiful which is not strong, or is not adequately strong for its purpose. The impression of duration is indispensable to that satisfaction and repose which the mind seeks in a well-ordered work of architecture. According to the simple notions of the ancients, it was the essence of the grandiose and beautiful. The temple of the eternal was to breathe the spirit of eternity—strong in its entire structure, it was to be strong also in its component parts, its "great stones." Energy, menta and physical, and stability, were the expressions most desired in architecture; voids were to be above voids, solids above solids; the area even of the supports, and the incumbent weight (orthographically considered) in most instances of the finest temples are, or approach to, equality.

To this end the whole composition of the edifice was pyramidal, the sides being inclined (as has already been observed) in every style of architecture known to us. The quoins and piers of the angles which inclose the work are larger than those towards the centre; and we may be sure that the expression of strength and duration given to a building is often of itself sufficient for beauty, without other adventitious ornament; as we may also be certain that the want of this quality cannot be repaired by any expedient which the architect may apply. In fact, the qualities of solidity and equipoise impose on the understanding the same awe and conviction with reason, justice, and truth; as inspiring that security, stability, and peace, without which all is flimsy conceit and vain ambition.

But this rational propensity is sometimes in jeopardy from the love of the marvellous and the exhibition of skill in the artificer, from whom, while we deprecate the hazard, we cannot withhold our applause; and if assured, either by the nature of the material or the quality of the structure, of the security the mind demands, we are easily reconciled to the wonder. But this temptation is often a severe trial to the ambitious architect; and without a sober taste, chastened by modesty and reason, it may be often more than he can resist.

We delight in the suspended arch of a bridge or in the enormous vault which covers the Pantheon, or the baths of Caracalla, or the Temple of Peace. We are reconciled to those of the Gothic cathedral, so long as their stone props or buttresses continue to perform their duty. Not so in the grove at the east end of Salisbury Cathedral, which, like the banyan tree, seems to be composed of pendants from the roof, in different dimensions, rather than columns to support it; beautiful, indeed, but so fragile that the blow of a stick or the movement of an awkward visitor would put the whole fabric in peril. If, instead of a friable stone or marble, these shafts were made of brass, the mind would relapse into that security which is ever the first requirement of our art.

The love of the marvellous is dangerous; exaggeration is the first sign of a mind indifferent to the value and beauty and sufficiency of truth, and the surest sign of depravation of judgment. Truth must ever be the best foundation of taste, and can alone be constant and enduring—

> Rien n'est beau que le vrai; le vrai seul est aimable!
> Il doit regner partout, et même dans la Fable.
> De toute fiction, l'adroite fausseté,
> Ne tend qu'à faire aux yeux briller la vérité.
> *Boileau*, Ep. ix., v. 43.

The Egyptian, the Roman, and sometimes the Greek, indulged in the gigantic, with a view to the expression of a prodigious energy. But the middle ages were prone to the marvellous, surprise was the great scope of the Gothic architect. Æsthetics were not, indeed, likely to have been studied under the education to which the mind at that time had access. Miracles infatuated the understanding; superstition was the foundation; a dominant hierarchy was little communicative of the lights of science it possessed. The poetical vein received its chief aliment from the east; our scholars brought home from Cordova the Arabian taste for excess and hyperbole. The chastening counsel of a Locke, a Newton, or a Bacon, were wanting to regulate that exuberant and uncultured fancy, and that enterprising skill which the practical experiments in building promoted at so much cost and zeal in those ages.

The two styles of building, till the 15th century, were termed *more Romano*, in semi-circular arches, which followed the old basilica model of St. Peter's and St. Paul's, and *more Germano*, in which the pointed arch was employed after the 13th century; it was in the latter taste that the greatest works were executed.

However great and admirable, in many respects, the specimens which have been left us by those able practitioners, it is not believed by the most competent judges that theoretical science was cultivated to any extent. From Cesare Cesariano, the architect of Milan cathedral, and one of the earliest translators of Vitruvius, doubtless one of the most learned architects of his day (1524), we may learn something of the principles which guided the middle ages, which were full of the mystical terms of the pseudo-science of the Freemasons. They consisted of a series of triangles or pyramids, no doubt in allusion to the triune, which guided the plan, elevation, and section; see D'Agencourt's architecture, plate 46, in which the sections of Milan and Bologna cathedrals illustrate those doctrines. The minster at Bath appears to have been built after this theory (1503) by Dr. Oliver King, who was a skilful architect and politician, and had been employed in France to conclude a peace with Charles VIII., and who, therefore, would be acquainted with the most approved art of that day on the continent.

The middle age church was wholly founded on superstitious associations. According to *more Romano*, it was enough that the plan described the cross, the universal symbol in "hoc vince." But according to *more Germano*, the Saviour himself was to be figured; the choir, therefore, was inclined to the south, to signify, that "he bowed his head and gave up the ghost," John, c. xx, v. 30; and there are few cathedrals in which this deflection in not remarkable. The nave represents the body, and the side, which "one of the soldiers pierced," (John, xix. 34), considered to be the south as the region of the heart, is occupied at Wells by a chantrey, at Winchester with the chapel of William of Wyckham, and is constantly the pulpit from which the faithful were reminded "to look on him whom they had pierced," Zech. xii. 10: who "was wounded for our transgressions," Isa. liii. 5. For the same reason the south was considered the most holy: the Old Testament was represented on that side, while the New Testament, and the local or national Hagiology, was placed to the north. The same superstition still gives value to the south side of the churchyard for burial. At the head of the cross was the chapel of the Virgin, at the Fountain of Intercession with her son. At the foot, the west end, was the "Parvis," supposed by some to be a corruption of "Paradis," that happy station from which the devout might contemplate the glory of the fabric, which was chiefly illustrated in this front and from whence they might scan the great sculptured picture, the calendar for unlearned men, as illustrative of Christian doctrine and of the temporal history of the church under its princes and its prelates. Three great niches leading into the church, the centre one often above forty feet wide, were adorned with the statues of the apostles and holy men, who "marshal us the way that we should go;" in front the genealogy of Christ, the Final Judgment, the History of the Patriarchs, &c.

The details, indeed, display the degraded state of the fine arts, and of course, of the artists themselves, in the quaintness and disproportion of the sculpture. But extending our indulgence to the performers, regarded in illiberal times only as workmen, we shall admire their native genius, struggling with their moral condition, often on the verge of dignity and grace in execution, and in point of conception frequently reaching an elevation altogether original. It must be confessed that the continental churches, especially those of Amiens, Rheims, and Paris, surpass the magnificence of our own cathedrals, both in the extent of plan by their double ailes, as well as by their height. But it may be questioned whether a more complete and correct picture of Christian doctrine and dispensation, and Christian history, is to be found anywhere than in Wells Cathedral.

But the same want of cultivated judgment which is apparent in the æsthetical of the arts of the middle ages, is traced also in the imperfection of their statics and stereotomy, in which again solidity is sacrificed to superstition. The indispensable figure of the cross is a striking example. The arches of the nave in the northern basilica, found their abutment abundantly in the western termination, which was commonly fortified by prominent buttresses (called by the early commentators of Vitruvius, tetra-style, or hexa-style, according to their number); but at their eastern termination, towards the lofty pillar of the transept, no such abutment existed. And though the pointed arch was eminently calculated to obviate lateral pressure, yet the smallest failure of foundation or superstructure, threw so much weight against these pillars as to occasion them to bend. To counteract this, and secure their stability, the principle of that age, of "pondus addit robur," namely, the weighting the pillars of the transept with a tower or spire, was resorted to very commonly; but this often increasing the evil, the last disfiguring remedy, the construction of a reversed arch between them, was employed.

Similar criticisms apply to all parts of the middle age architecture, mixed, however, with redeeming excellencies of peculiar skill hitherto unsurpassed.—See sections 1 to 8 of Wren's surveys, in the "Parentalia," 264 to 309.

The fifth of those principles of Vitruvius, which the Professor had attempted to illustrate, was Decor, usually considered to refer to that important part of architecture, ornament; but our author rather appeared to refer to consistency of character, fitness of style and ornament to the Deity, and the purpose or the rank to which the work might be dedicated, quoted in the preceding lecture. But as no part of the art required a nicer judgment, tact, and reasoning than this of character and special physiognomy, so was none more commonly transgressed in many modern buildings; and a stranger might be conducted to some of them, and defied to guess whether he beheld a library or a town hall, a church or a music room, a theatre, a prison, a brewhouse, or a floor-cloth manufactory, a gentleman's mansion or a union workhouse.

Appropriateness and fitness of character is the special recommendation of all the great critics, from Aristotle to Pope. If, says Horace, to a horse's neck a human head is joined, or a female head and breast should terminate in a fish, you will despise the painter; or if upon the stage you exhibit the graces and the levities of youth, hashed up with the manly strength of middle life or the rigour of old age, the audience would yawn, and at length overwhelm you with indignant hisses. It is, in fact, the significance and appropriateness resulting from the coincidence of use and beauty, the one the explanation and plain result of the other, which we adore in the works of Nature, and which the great artists have best known how to imitate in theirs.

Sir C. Wren remarks on the Temple of Peace—"It was not, therefore, unskilfulness in the architect, that made him choose this flat kind of aspect for his temple; it was his wit and judgment. Each deity had a peculiar gesture, face, and dress hieroglyphically proper to it, as their stories were but morals involved; and not only their altars and sacrifices were mystical, but the very forms of their temples. No language, no poetry can so describe Peace, and the effects of it in men's minds, as the design of this temple naturally paints it, without any affectation of the allegory. It is easy of access, and open, carries an humble front, but embraces wide; is luminous and pleasant, and content with an internal greatness, despises an invidious appearance of all that height it might otherwise boast of; but rather, fortifying itself on every side, rests secure on a square and ample basis." On the Temple of War, he says, "As studiously as the aspect of the Temple of Peace was contrived in allusion to Peace and its attributes, so is this of Mars appropriated to War; a strong and stately temple shows itself forward, and that it might not lose any of its bulk, a vast wall of near 100 feet high is placed behind it; (because, as Vitruvius notes, things appear less in the open air;) and though it be a single wall, erected chiefly to add glory to the fabric, and to muster up at once a terrible front of trophies and statues, which stand here in double ranks, yet an ingenious use is made of it, to obscure two irregular entrances," &c.

The German Moller, who is as true and as accomplished an artist as any of modern times, on this point says, "On comparing the elevation of the Merchants' Guildhouse, at Mentz, with the church of Oppenheim, which was finished in the same year, we see how anxious the ancients were, and how well they contrived to impart to every building its peculiar character. Just as the merit of historical painting, and of every art of design, (without which all the rest is valueless,) consists in the importance and peculiarity of its character, so they are principal requisites in buildings, whenever the latter lay claim to the appellation of works of art. In the church at Oppenheim, all the parts are lightly towering up, so that the eye of the spectator in the interior is involuntarily raised, and the elevated richly ornamented windows, and slender aspiring pillars, promise from the outside already a beautiful and sublime interior. But in the Merchants' Guildhouse, the whole exterior announces at once an object very different from that of a church. The few and small windows are easily closed against fire and robbers; and their battlements again, with their projecting canopies and angular enrichments, clearly show that the destination of the building is to preserve and to protect. And in the same way as the main forms correspond with the object of the structure, so likewise do the ingeniously designed ornaments. On the pinnacles or battlements are the figures of the emperors and electors in full armour. The emperor, who, at that time in alliance with the electors, had confirmed the commercial union of the cities on the Rhine, and taken them under his protection, appears with them here, as the guardian and bulwark of the house. In the midst of the princes, is the figure of St. Martin, the patron of the city, dividing his cloak with his sword, to give it to the poor. Thus, the leading forms announce the destination and solidity of the building; the figures of the princes, the protection it enjoys; St. Martin, that beneficence which ought to be the attendant of wealth; and the Virgin Mary with the infant Jesus, over the entrance, the higher safeguard which the Divinity grants only to the *just*." Thus says the accomplished Moller.

It is a fine observation of Aristotle, that "a noble building without ornament is like a healthy man in indigence." Competence, if not wealth, must be added for the accomplishment of his happiness.

The sculptor's art affords the noblest ornaments to the architect. By his aid, the expression which he has been labouring to give by other associations, and which before was mute, or scarcely audible, becomes *parlant*. Sculpture may be called the voice of architecture. Unhappily a Protestant country, with the holy fear of image-worship, discourages this generous and most essential art; and perhaps the want of character complained of in architecture may be mainly attributed to this proscription.

But the carver and the decorator are highly serviceable to the architect, not only as multiplying images for the delight of the eye and the explanation of the subject, but as greatly magnifying the scale of the whole by these means, and giving value and distinction to the plainer features. Our mistress Nature is prodigal in ornament, and the expression of every animal and vegetable is increased by a texture of endless detail spread over the whole surface of her works.

Finally, Distributio, the οικονομια of the Greeks, the sixth principle, is explained by Vitruvius, drily, as economy in the use and cost of materials; but doubtless the great masters from whom he borrowed, considered economy, in the larger sense, as the adjustment of means to the end; as the wise and fine thought, contrivance, and supply, of all the requirements and appliances of the building art; in which the highest intelligence is displayed; such, indeed, as by that figure of speech which designates great subjects by small titles, applies to the *Creator* himself that of the great architect.

The diligent observer of architectural works will find the greatest strength combined with the least material, beauty united with use, and resulting from it, exact equilibrium, provisions for the accidents of time and climate, selection of materials best adapted, in short, a prescience of every want and consideration: throughout the contrivance admiration almost sublime is occasioned; we feel that the work has, as it were, been self-created by the influences and the wisdom of nature, and as if the architect had only followed her instructions. "I am not," says the heifer of Myron, "the work of Myron—he only delivered me from the marble" in which I was inclosed.

Having thus reviewed the theoretical rules handed down by Vitruvius from the Greeks, as far as the limits and means permitted, the Professor proceeded to offer some observations to the students, with reference to their future advancement, which it was the object of these lectures, and the ardent wish of the members of the academy to promote.

First, with respect to drawing, which was the very language of the art, it was extremely important that the distinction between the painter and the architect should be clearly understood. He deprecated the vain ambition of making pretty drawings, especially on a small scale, as effeminate and uninstructive; as also of pretensions to aërial perspective, which was a separate art. Much time was commonly occupied in this captivating study, which was wholly irrelevant, and at the expense of that valuable time which should be employed in the more essential accomplishments of the art and science. It might, indeed, improve the hand, but not the head; of which the architect had so much need. Drawing after the manner of painters had undoubtedly been an abuse and misdirection.

The orthographic drawing or elevation was conventional: it represented the proposed building from an immeasurable distance—the object being to define those proportions and profiles which constitute the merit of the work—such lights and shades as should more clearly display these forms, and show their relief where necessary; but whatever disturbed these paramount objects, as colour, or such cast shades as might confuse the profiles and pretend to illusion, were impertinent.

Perspective, in the most accurate delineation, was, indeed, a most desirable accomplishment, but it should be wholly linear, assisted with one tone, or two at most. Sciography should be used with great reserve, since the harsh outlines of cast shades were apt to disturb the form and outline; and the finest architectural perspectives, those of Pozzo especially, left them softened and undefined on this account. It was certain that such had been the practice of the great Italian masters, specimens of which, by the hands of Sansovino, (the front of Sta. Maria, at Florence, in the possession of Woodburn,) of Michael Angelo, Raphael, and others, and especially the designs for Whitehall, by Inigo Jones, the Professor had exhibited in a former course. Exquisite perspective, proportion, and profile were more scientific, difficult, and much more profitable to the student. The coloured picturesque was a pandering to a depraved taste, and it was a duty to inform the public on this head, and lead them to the appreciation of the true intent of architectural delineation. The draftsman should be habituated to a large scale, and a manly drawing of profile and detail, such as a builder would comprehend and work from. The Professor exhibited a specimen of the architectural drawing of the actual school in Paris, which, though not wholly to be approved, as being rather too minute and elaborate in effect, still showed a more careful attention to outline, and a better system than used by ourselves.

The architectural room in the annual exhibition was at great disadvantage in the neighbourhood of the splendours of the sister art; the vain attempt at vying with her productions in architectural drawings, had both corrupted our style and exposed the utter futility of the attempt. The true course would be a closer adherence to the province of the architect in a more correct delineation of profile and proportion, and in the most accurate linear perspective; a tasteful employment of these resources would probably more effectually uphold the interest of that room than any other means that could be devised.

Constant observation and travel were essential to the architect; but the interesting objects of our own country should be seen before those of others. Much time was often lost in foreign travel by misdirection and the dangerous novelty of the student's position.

In examining architectural works, the student should bear in mind an important rule of criticism, which was, to account in precise terms, for the motives of approbation or dislike which he might experience. By applying a just expression on all occasions, he would soon cease to take one thing for another—the beautiful for the sublime—quantity for quality—cost for magnificence—and either of these for proportion or fitness—ornament for art. He would learn to apply characteristic terms to every gradation, quality, and style: and so, by degrees, he would form a just and discriminating taste.

In an art and science essentially referable to association, this discrimination was peculiarly necessary: the emotions arising from sight, like those from music, would often be found irrespective of the intrinsic merit of the performance, as loyalty in hearing "God save the Queen," union and patriotism in the "Marsellaise." Often patriotic, historical, and romantic associations will blind us to forms and styles, otherwise both unfit and unworthy our age; often quantity, extent, and quality of material would impose that approbation which ought only to be accorded to elegant and just proportions; elaboration would often usurp the praise which was due only to a well-ordered work.

To hide by ornament the want of art,

should not deceive the experienced critic; and the painter "who would make his Venus *fine*, not knowing how to make her *beautiful*," would be ranked as he deserved. The discernment of merits rather than defects will be found more difficult, and much more profitable, because those we shall appropriate, while the latter are only to be rejected. Such a habit will exercise the better qualities of the mind, and lead to originality. The works of men who have long enjoyed reputation, should be the peculiar objects of our critical examination; they will seldom be found frauds; the inquiry will commonly justify their fame, and like the conversations of original inventors, they will reveal secrets which can else hardly be discovered.

The antiquary should be distinguished from the architect, and he should be careful to separate the available experience, from research into the curious and obsolete.

The student was recommended especially to cultivate that manly independence of mind which became a thinker, and the leader of an art; he should have a settled distrust of fashion; although he would find himself sometimes constrained in some measure to bend to it. Those "who live to please, must please to live;" he should, however, courageously but respectfully remonstrate.

There were two rocks, which the art was expressly liable to: the first was the presumption of absolute novelty; the second, the indolent and servile imitation of former styles. The latter was the peculiar vice of these times throughout all the civilized countries of Europe. Grecian, Gothic, Byzantine, Italian, Revival, French, were indifferently employed. There was no attempt at a style which should express to future ages the century in which we live; and posterity will be at a loss to recognize in the buildings of our day, that character which a country great and glorious at the present period, the bulwark of civilization, the arbiter of the world, and the great exemplar of political government, morals, and useful science, should impress upon its architectural productions. Shall it be said that this great people, original and free in other respects, adapting and expanding itself in an unexampled manner to times and improvements, was stationary, or rather retrogade, in the arts alone? That though science and capital and mechanical skill were daily furnishing new engines for our art, with prodigality, that our invention alone in these walks of genius was at a stand? that our skill as artists was the only deficiency in the march of our age? That they crudely adapted the models of ancient Greece to modern London, the sunny palaces of Italy to the foggy atmosphere of England: the niched and canopied architecture of a religion peopled with images of saints and martyrs, sibyls, angels, and holy men, to a Protestant religion, which, admitting none of these, must leave the niches and the canopies *tenantless*: like well-guilt frames adorning an apartment, the *pictures* being omitted: the pride and pomp of heraldry, armorial shields and crests, to an age in which chivalry was exploded, and quarterings had dwindled to insignificance? What should we say of Harry the Sixth, if, instead of that admirable and most original chapel of King's College, at Cambridge, he had limited his artists to the style of the Conqueror, or any other imitation; or if Henry the Seventh had concluded on carrying on the style of the cathedral of Henry the Third, and so on, saving all further trouble of invention and criticism, should we not contemn their poverty of spirit and negation of mind? Would not the historian, the artist, and the tasteful observer, have to deplore the absence of that internal evidence and hieroglyphic character of the times, which adds such a relish to the architectural remains of our fair and beloved country?

But let us suppose that either of these monarchs had been enlightened by the art of a Raphael or a Michael Angelo, or by the sculptures of a Phidias, which he might even affect to appreciate and to be proud of; and that we should learn by historical record that he had said—"We are so anxious to carry out the style of former days that we shall shut our eyes to those excellencies of sculpture and of fine art, and force our artists to copy the obscenities and senseless carvings of those barbarous times; simply that we may carry out the imitation of the style in all respects."

Restoration, indeed, is a different consideration, and the happiest result of this taste is, that we reinstate, for centuries to come, those venerable antiquities to which we have so many reasons of attachment. The restoration of the Palace at Westminster may find under this consideration a sufficient apology. But for works altogether new such a system of imitation is not reconcileable with our pretensions to genius and enlightenment; and it does appear that there is in it a vice of mind or of industry for which posterity will visit us. Such an indifference as to choice of styles indicates, in fact, an absence of culture and perception of the really fit, and beautiful, and great—a state of mind which, in religion, politics, or morals, would be accounted fatal to improvement, and the sure forerunner of every heresy. D'Agencourt attributes to this spirit of imitation under the Emperor Hadrian the decline of taste in Rome.

The learned in Paris deplore it not only under this apprehension, but as the imposition of anachronisms on posterity, and as the falsification of the pages of history, in its most interesting and characteristic traits. "Have we not," as says Isaiah, "a lie in our right hand?"

It is very important that the merits of that question should be debated in a candid spirit, and that the true grounds of a style should be investigated by the rules of sound criticism; as how far architecture has ever been and should be the picture in which all the discoveries of mechanics, of materials and of industry, are to be exhibited and recorded; and whether the successive changes of style have not been chiefly owing to the progressive discoveries and improvements on workmanship, materials, and convenience. How far the combinations of this art are capable of displaying the intellectual character of an age and people, and what should be the just bounds and limits of association, authority, and imitation.

Finally, let us never forget the pregnant saying of the great Schiller:—

> The artist is the son of his time;
> Happy for him if he is not its pupil;
> And happier still if not its favourite.

In conclusion, the Professor expressed the gratification he had felt in the attention paid by the students to this course of lectures; not as it reflected upon himself personally, but as it gave the strongest possible evidence of the ardour and assiduity with which they pursued their studies: for he could with great sincerity assure them that, amongst the achievements of a very long period of singleness and devotion to his profession, he should consider that the most glorious, which had contributed to the instruction, and warmed the enthusiasm of those rising talents destined perhaps in future times to adorn and illustrate our country.

INSTITUTION OF CIVIL ENGINEERS.

Feb. 7.—The PRESIDENT in the Chair.

"*Description of a Drawbridge at Bowcombe Creek, near Kingsbridge, Devon.*" By George Clarisse Dobson, Assoc. Inst. C.E.

This drawbridge spans one of five openings in a stone bridge, built across a navigable branch of Salcombe Harbour; it is in one leaf, 15 ft. 9 in. wide, and 32 ft. long, from out to out, supported upon a cast iron shaft or axle, placed 7 ft. 6 in. from the inner end, working in the abutment pier, which is built hollow to receive it, and thus the part within the axle end acts as a counter weight. To the centre of the end cross-beam of the counter part, a chain is attached, and after passing over cast iron sheaves in the masonry of the face of the abutment, is coiled on a drum fixed on a horizontal shaft, carrying on one end a pinion, worked by a rack, attached to the piston of the hydraulic press; by this means, motion is given to the shaft and drum, and consequently to the leaf of the bridge. Balance boxes are hung to the counter end, by which the shutting is regulated. The struts for supporting the leaf, when raised, are also thrown in and out of their places by a rack and pinion. The hydraulic press used for opening and closing the bridge, is simple in its construction, and the whole works so easily, that a female can open and close the bridge in about 15 minutes without difficulty. The fresh water used for the pump is contained in a cistern beneath, and seldom wants replenishing, as it is returned into the reservoir every time after being used. The bridge was designed and erected by Mr. J. M. Rendel, about 12 years since, when he was engaged in improving the turnpike road in the south of Devon. The expense of repairing, oiling, packing, &c., since its erection, has averaged under 7*l.* per annum, including a small salary to a neighbouring millwright for occasional inspection. The communication is accompanied by a drawing, showing a plan and sectional elevation of the bridge and the machinery.

ON FRICTION.

"*An Investigation of the comparative loss by Friction, in beam and direct action Steam Engines.*" By William Pole, Assoc. Inst. C. E.

In consequence of the comparatively recent introduction of direct action steam engines on board the steam vessels of the Royal Navy, the attention of engineers has been drawn to the advantages or disadvantages they possess, when viewed in comparison with those constructed with side levers. The object of this paper is to investigate the value of an apparently formidable objection which has been frequently urged against the direct action engine, namely, "that from the more oblique action, consequent upon the shortness of the connecting rod, the loss by the increase of friction is so considerable as to constitute a serious objection to this form of engine." After explaining to what extent mathematical analysis is applicable for determining the amount of friction, the paper proceeds to show that it may be satisfactorily used in the present case, as it is only the friction caused by the strain, or load, which is involved in the objection, and this is more adapted for theoretical than experimental determination.

The three general laws of friction, as established by the best experiments, are,

1st. That the friction caused by one solid body rubbing upon another, is independent of the velocity with which the rubbing surface moves.

2nd. It is also independent of the area of the rubbing surface.

3rd. It is proportional to the pressure upon this surface.[1]

From these it will follow, that if the pressure upon a moving body be multiplied by a certain co-efficient of friction (whose value is dependent upon the nature of the rubbing surface), the product will be the resistance from friction; and this multiplied again into any space the rubbing surface moves through, will give the amount of "power, work, or labouring force," expended in overcoming the friction through that space.[2] If the pressure upon the moving body be variable throughout its motion, the differential calculus must be employed, but the principle of calculation is still the same.[3]

The paper proceeds to deduce general mathematical expressions for the amount of friction on each bearing of an engine, by finding, first, by ordinary statical rules, the pressure thrown on each particular bearing by a given force applied to the piston, and then combining this with the space through which the rubbing surface moves. This is done for the beam engine, and for three modifications of the direct action engine. Equations are also added for the oscillating or vibrating engine, and for an arrangement in which the connecting rod is supposed to be indefinitely lengthened. The numerical values of the expressions for friction thus found, are then calculated for an engine upon each of these different constructions, supposing them to be similar in all other respects, having the cylinders 66 inches in diameter, with a length of stroke of 6 feet; and the results are shown in a table, distinguishing the friction of every bearing. From this it appears that as respects the friction caused by the strain, if the beam engine be taken as the standard of comparison—

The vibrating engine	has a gain of	..	1·1	per cent.
The direct action engine with slides	loss	..	1·8	"
Ditto with rollers	gain	..	0·8	"
Ditto with a parallel motion	gain	..	1·3	"

This difference being so trifling, it is contended that the objection to the direct action engine, on the ground of its alleged increased friction, has, when investigated, no adequate foundation.

Mr. Field believed that the paper was correct in its view of the comparative amount of friction of the two kinds of engines. He was of opinion that an excessive allowance for friction had hitherto been generally made in calculating their effective power. It was found practically, that when the pressure upon the piston was about 12 lb. per square inch, the friction did not amount to more than 1 lb. or 1½ lb. per square inch. This was easily ascertained by the indicator, when the engine was working without a load, but when loaded, he knew of no accurate experimental mode of showing it. At the engines of the Blackwall railway, the experiment had frequently been tried, by casting off all the load, and so regulating the steam, that the engines should make only the regular number of strokes per minute; the result had invariably shown about 1 lb. per square inch for friction.

Mr. Taylor confirmed the preceding remarks; it had been the custom formerly in large pumping engines to allow one-fifth for friction, but modern practice had shown that this was not necessary, particularly since greater precision had been introduced into the construction of all kinds of machinery.

Mr. Miller agreed that the friction of engines generally had been over-

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[1] Poisson, Traité de Mécanique, 2nd edition, art. 456.

[2] If m = the co-efficient of friction, P = the pressure, and S = the space moved through, then the power expended = mPS.

[3] Let x be any space moved through: let X represent the variable pressure, expressed in terms of x, then the power expended = $m \int X\,dx$.

rated; he believed that as a simple comparison of the friction of the main parts of two kinds of engines, the results arrived at in the paper might be received as correct; but there were several other questions which must be considered, if it was intended to establish a general comparison between the beam and the direct action engines; this, however, he believed was not the intention of the author.

Mr. Murray contended that the second proposition in the paper, which assumed that "friction was independent of the area of the rubbing surface," although supported by Coulomb and the early experimenters, had been proved by Vince and others to be incorrect; it was natural to suppose that in proportion to the hardness and smoothness of bodies, there would exist a different ratio for the best proportion of surface to weight for every different body; if a surface carrying a given weight was of less than the due area, the surfaces would cut into each other, become rough, and thus increase the friction; on the other hand, if the surfaces were unduly enlarged, there must be a loss from the additional amount of friction caused by the extended surface. He conceived that the calculations in the paper must be affected by the incorrectness of the data upon which they were based. The simple mode of comparing the beam engine with the direct action engine appeared to be, to suppose two engines of the same length of stroke and diameter of cylinder; the proportions being good, it would be indifferent whether the power was transmitted through a direct connecting rod or through side levers; the cylinders, air pump, arrangement of parallel motion, &c., being supposed to be alike, the friction of these parts would be alike in all cases, and the comparison would be limited to the parts employed in transmitting the power from the piston rod cross head to the crank pin; both connecting rods have the same number of bearings, which in both cases travel with friction over nearly the same distances: it is allowed that the bearings of the shorter connecting rod have a larger amount of friction, and that from the greater angle it assumes, more friction is thrown upon all the bearings of the parallel motion, on account of the greater force required to retain the piston in a vertical position. To counterbalance the increased friction on these parts of the direct acting engine, allowance must be made in the beam engine for the friction of the beam centres and of the top and bottom necks of the side rods. The friction being directly as the distance moved through, and the distance in the side rod ends being so very small, it follows that the amount of friction must be very trifling. The distance travelled by the beam centres is greater, but it is not of importance, as it is the angular distance due to the vibration of the beam, measured on the circumference of the gudgeon. Under these considerations Mr. Murray was disposed to give the preference (if any existed) to the side lever engine. In a pamphlet[4] published in 1840, by Mr. John Seaward, it is stated that four-fifths of the whole friction of an engine were absorbed by the packings of the piston and air-pump bucket, by the slide valves and by the different packings or glands; consequently one fifth was due to the whole of the necks or bearings throughout the engine. Now on considering the large proportion of this amount of the friction that is due to the bearings of the main shafts, of the crank pin, and of the bottom end of the connecting rod, and of all those other bearings common to both sorts of engines, it must be evident that the total amount of the friction due to those parts in which a difference between the engines exists, must be but a small portion of this one-fifth. Taking one-tenth or ten per cent. of the whole power of an engine, as the amount of power required to overcome the friction of the engine itself, which was allowed to be ample, one-fifth of this would be two per cent., and therefore the degree in which either engine could surpass the other in the amount of friction, could only be, as already stated, a small portion of this two per cent. In comparing the efficiency of these engines, it would thus appear that neither could be said to possess advantages over the other, as regards friction, in such a degree as to be appreciable in practice, or to render the point of importance in a choice between the engines; and that if the one kind of engine had advantages over the other, they must arise from other causes than difference in friction. Having taken this view of the case with a supposed side lever engine, of the same length of stroke and diameter of cylinder as the direct action engine, if manufacturers varied in a slight degree from this proportion, it was for the purpose of obtaining a better proportion of stroke and diameter of cylinder, and consequently a better engine than the one supposed to exist for the purpose of making the observations.

Mr. Vignoles looked upon the second proposition assumed by the author, as being overthrown by the results of the experiments of Wood and others, as to the ratio of friction to the area of rubbing surface; and it was well known practically, that the application of various unctuous substances materially altered the amount of the friction. A certain proportion was requisite between the area of the surface exposed to the friction and the pressure upon it, to bring it within the general law. For practical purposes, he submitted that the law should be received with limitations.

Mr. Gravatt said, that even allowing, for the sake of argument, that the second proposition assumed by the author was incorrect, still as the paper was only a theoretical examination of the comparative friction of those parts of two kinds of engines, which were most subjected to strain, supposing them both to be of similar power and dimensions, equally well proportioned and constructed, and the same sort of lubrication of the bearings employed, he would contend that the circumstances being equal, equal results would be obtained, and that the conclusions arrived at by the author should be received as correct.

Mr. Pole observed, that the objections brought forward were important, as they referred principally to the fundamental laws of friction. He would first give some explanation respecting the communication itself. The investigation was commenced at the request of his late friend Mr. Samuel Seaward; it was originally intended to have especial reference to the Gorgon engine, but had subsequently been extended to others. The paper, necessarily containing much mathematical reasoning, could only be read in abstract, and might, therefore, have been partially misunderstood, both as to its objects and results. The object was, not to enter into a discussion of the whole question of the respective merits or defects of beam and direct action engines, but simply to ascertain the value of the one objection named.

The whole friction of an engine at work with its load upon it, might be divided into two distinct parts. 1st. The friction due to the engine itself, or such as would be produced by the working of the engine, if unloaded. 2nd. The additional friction caused by the strain consequent upon the load; for it must be evident that when the engine had its work upon it, the friction upon the bearings through which the strain passed, must be increased, and additional friction produced, beyond that which would exist when the engine was working without a load. The latter of these alone required to be calculated, and to this mathematical analysis was more peculiarly adapted. The friction of the engine unloaded, might be ascertained by the indicator, as described by Mr. Field; but as he had remarked, there was no practical method of finding what was the additional friction when the load was applied; indeed, it would be as difficult to find the latter by experiment as the former by theory.

He then explained the manner in which the amount of friction upon each bearing had been calculated, and engines of different constructions compared with each other. He had adopted precisely the plan suggested by Mr. Murray, namely, by taking engines of the same length of stroke and diameter of cylinder, supposing them to be equally well proportioned and constructed, and in equally good condition. But instead of assuming, as Mr. Murray had done, that there was somewhat more or less friction on any particular bearing, his object had been to ascertain what was its actual value. If it were impossible to measure the pressures and spaces moved through, an approximation might be received; but since these quantities were ascertainable, it was more satisfactory to obtain results deduced from them. The conclusions drawn from the paper accorded, however, with Mr. Murray's, viz. that "neither construction could be said to possess advantages over the other, in such a degree as to be appreciable in practice, so as to render the point of importance in a choice between them." The difference between Mr. Murray's process and that in the paper, was, that what the former only assumed, the latter endeavoured to prove.

Mr. John Seaward's pamphlet on the Gorgon engine had been referred to. The conclusions he there drew were more favourable to the direct action engine, but were derived, like Mr. Murray's, merely from approximate consideration, rather than from strict investigation. Mr. Seaward confessed, that the friction caused by the strain was difficult to be calculated, and had therefore contented himself with assuming, that those gudgeons through which the strain passed, had three times as much friction as was due to the others. He also assumed that the friction was proportional to the area of the rubbing surface, a principle which no experiments had ever shown. On these grounds, it was contended that Mr. Seaward's results were open to objection.

Mr. Pole then proceeded to notice the objections urged against the fundamental laws of friction which he had stated, and to give authorities for them. The first of these had not been questioned since the days of Vince, by whom it was proved; it might therefore be considered as established. With regard to the second and third, it must be noticed that they depended, in some measure, upon each other, for it could be proved that if the third was true, the second must be true also. The principal experiments which had been made upon the friction of solids, were those by Amontons, in 1699; Coulomb, in 1779; Vince, in 1784; Wood, in 1818; Rennie, in 1828; and Morin, in 1831, 32, and 33. Amontons was the first who devoted any considerable attention to the subject, and he found that friction was not augmented by an increase of surface, but only by an increase of pressure.[5] Coulomb's researches were more elaborate, the experiments were on a large scale, and were submitted to a great variety of trials; they fully proved that the friction was proportional to the pressure, and that the extent of surface did not affect it.[6] These results were further confirmed by the experiments of De la Hire, Ximenes, Boistard, Rondelet, and others. Mr. George Rennie's experiments were very valuable, as having been conducted on a large scale, and with much care; they were also of a comparatively recent date. The results were conclusive on the point in question, for he found that when the surfaces were to each other as 6·22 : 1, the friction remained the same,[7] and one of the general conclusions he deduced was, "that the amount of friction was as the pressure directly, without regard to surface, time, or velocity."[8] The last and most extensive series of experiments were those by M. Morin; they were conducted at Metz, by order of the French government, and ex-

[4] "Description of the engines on board the *Gorgon* and *Cyclops* steam frigates, with remarks on the comparative advantages of long and short connecting rods, and long and short stroke engines." By J. Seaward. London, 1840.

[5] Vide Phil. Trans., 1829, p. 145.

[6] Mem. des Savans Etrangers, 1781. Vide also Ency. Brit. New Edit., Art. Mechanics.

[7] Phil. Trans. 1829, p. 156.

[8] Ibid. p. 170.

tended over a period of three years (1831, 1832, and 1833), no expense or trouble having been spared to render them conclusive and satisfactory.[9] The results were given by Professor Moseley, in his new work on the mechanical principles of engineering.[10] They proved that "the friction of any two surfaces was directly proportioned to the force with which they were pressed perpendicularly together," and that "the amount of friction was, in every case, wholly independent of the extent of the surfaces of contact."[11] The before mentioned experiments all agreed, that the friction was proportional to the pressure, and was independent of the extent of surface. In opposition, however, to these, stood the experiments of Professor Vince, of Cambridge,[12] which led him to the conclusion that the friction increased in a less ratio than the pressure, and that it was not altogether independent of the area of surface. These experiments were probably conducted with care and accuracy; but it was also probable that equal precision had been used in those which proved the contrary; and if this was allowed, the majority of coinciding experiments might, as in all other cases, be safely received in preference to one dissentient. But if the particulars of Professor Vince's experiments were examined, many circumstances appeared which would render them less worthy of regard than others. It was not shown that he experimented upon metals, but that he used pieces of wood, either bare or covered with paper, and the experiments were on a small scale, the moving bodies being at the utmost a few ounces weight; while Coulomb, Rennie, and Morin, had extended their trials to all kinds of materials, and had used considerable weights. Professor Vince himself, although satisfied with the method of conducting his experiments, did not seem equally so with their results, as regarded the influence of surface and pressure, for he had remarked, "that no general rule could be established to determine it, even for the same body."

Quotations were then given from Gregory, Brewster, and others, corroborating this view of the inconclusive and unsatisfactory nature of Vince's experiments. The law of the influence of pressure and surface upon friction, was occasionally modified by accidental circumstances, two of which might be noticed, as they had been expressly treated of by Rennie and Morin.

1. It was only applicable within the limit of pressure which would not injure and abrade the surfaces; for when heating and undue attrition commenced, it was natural that the law would not hold good. Well-constructed machinery, however, was never supposed to pass this limit, and therefore this cause of irregularity might be rejected in calculation.

2. Another modification was produced by the application of unguents; this was treated of by Mr. Wood,[13] whose experiments showed that when unguents were introduced, there was a certain area of bearing surface, proportioned to the weight, which was peculiarly favourable as regarded the loss by friction, but that when this area was preserved, the friction was in strict ratio to the pressure.

It could not, however, have been Mr. Wood's intention, from these results, to impugn the applicability of the established general laws to the purposes of calculation, but only to show the existence of modifying circumstances under certain conditions; for the formula he had given[14] assumed the friction to be as the weight, and had no element in it expressing the area.

Mr. Rennie and M. Morin had also examined the influence of the unguents, and had found that their introduction did not materially alter the general laws of friction, but only affected the value of the co-efficient or multiplier to be used in ascertaining its numerical amount.

Having thus brought before the meeting the result of the principal experiments on friction, Mr. Pole concluded by adducing the testimony of writers on mechanics, who guided by these results, had promulgated the laws deduced from them. He gave quotations from the following authors in corroboration of his views, *viz.*—Emerson,[15] Playfair,[16] Tredgold,[17] Barlow,[18] Lardner,[19] Farey,[20] De Pambour,[21] Poisson,[22] Pratt,[23] Whewell,[24] and Moseley.[25] With the last mentioned author Mr. Pole had taken an opportunity of conversing upon the points in question, and the principles adopted in the paper had received the Professor's full approbation as corresponding with those made use of in his own treatises.

Mr. Vignoles thought that great praise was due to Mr. Pole, for the research and mathematical reading exhibited in treating the question of comparative friction. In the former remarks he had made, it was not his intention to impugn the accuracy of the abstract proposition, "that friction was independent of the area of bearing surface," any further than to qualify it in its practical application, with the proviso, "that proper proportions were maintained between the area and the pressure, according to the description of mechanism, subjected to friction." He therefore desired to consider the question, as to how far in practice one kind of engine varied from the other in the general amount of friction, and to examine how far the areas of the bearing surfaces, were in proportion to the insistent weight, caused either by the strain of any angle or by the direct weight on any of the journals of the moving parts; this inquiry should precede the abstract mathematical investigation. The friction of different substances would not follow the mathematical rule, unless the due proportion between area and pressure was ascertained and observed; these proportions would be very different in heavy machinery, such as marine steam-engines, and the axles of railway carriages. With these qualifications he agreed with the general propositions laid down by Mr. Pole.

Mr. Murray agreed with Professor Vignoles in thinking that the extent of surface in machines materially affected in practice the amount of the friction. He did not mean to advocate the correctness of Professor Vince's experiments, but he would draw attention to the results quoted by Dr. Gregory,[26] in which the difference of Vince's experiments and those of other writers on the subject, was attributed to their not taking into account the cohesion of the bodies experimented upon. Their experiments were made with inclined planes, which were raised until the bodies began to move, and the amount of friction was then deduced from the angle of inclination that had been given to the plane: from this mode it was contended that no definite laws could be laid down. Mr. Murray acknowledged that on dry surfaces, within certain limits, the amount of friction was not influenced by the extent of surface; but he contended that in practice, as different kinds of unguents were used, the cohesion arising from the impurity and clamminess of these lubricating substances, must be considered and allowed for.

Major-General Pasley said that when he was quartered at Malta, he tried some experiments on friction, by having a slab of Maltese stone, which resembled the oolite of Bath, rubbed smooth and placed horizontally; other pieces of smooth-faced stone of the same quality, but of different areas, were then attached to a cord which was weighted and passed over a pulley; the weights which were just sufficient to give motion to the several pieces of stone, were then noted, and it was found that the area of the surface was not important, the friction being directly in proportion to the insistent weight of the stone. He could therefore corroborate Mr. Pole's propositions.

Mr. Farey considered that Mr. Pole had treated the subject of friction so well, and had selected his authorities in such a manner as to establish his position incontrovertibly; he would therefore only remark, that in collating the friction experiments for his work from Dr. Gregory and others, he had in a measure rejected those of Vince, as being on too small a scale, and not of sufficient importance to rely upon as authority. It must be admitted, that viewing the question practically, there were circumstances which would influence the proposition. If the surface of a journal was so small as to drive out the unguent, or to cut into the lower bearing, the friction would be unduly increased, and the theoretical position would no longer hold good. The use of unguents would not interfere with the general proposition, although in practice, any substance used for lubrication, which, when cold, solidified and became adhesive, might, for a time, produce an increase of friction; this of course would be avoided, but it would not bear upon the general question.

Mr. Rennie corroborated the position assumed by Mr. Pole, "that friction was independent of the extent of the rubbing surface;" his experiments, which had been tried on a large scale, and with various substances, gave uniformly this result, within the limits of abrasion; when that commenced, the bearings heated and there was an end of the theoretical position. The texture also, of the rubbing surfaces altered the condition; for instance, any light body covered with cloth opposed a considerable resistance by the friction of the raised nap; but if the body was weighted, it again came within the limits of the law, because it more nearly resembled hard substances, which alone were considered in theory. Hard and soft woods varied, of course, in the same manner. The friction upon each other of metals of different degree of hardness, caused in practice, some little variation, but it was so slight, that the rule quoted, might be safely received as correct.

Mr. Davison stated that he some time ago made several practical experiments with an Indicator, constructed by Messrs. Maudslays and Field, for the purpose of ascertaining the power required to drive various kinds of machinery, in Messrs. Truman, Hanbury, Buxton, and Co's Brewery.

1st. He found, that an engine which indicated 50 horses power when fully loaded, showed, after the load and the whole of the machinery were thrown off, 5 horses, or one-tenth of the whole power.

2nd. 190 feet of horizontal, and 180 feet of upright shafting, with 34 bearings, whose superficial area was 3300 square inches, together with 11 pair of spur and bevel wheels, varying from 2 feet to 9 feet in diameter, required a power equal to 7·65 horses.

3rd. A set of three-throw pumps, 6 inches in diameter, pumping 120 barrels per hour, to a height of 165 feet, = 4·7 horses.

By the usual mode of calculation, (viz., 33,000 lbs. lifted one foot high per minute,) it would appear that there was, in this case, friction to the extent of 13 per cent.

4th. A similar set of three-throw pumps, 6 inches in diameter, pumping 160 barrels per hour, to a height of 140 feet, = 6·2 horses.

By the same mode of calculation as before, there was here, friction to the amount of 15 per cent.

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[9] Mem. de l'Institut., 1833, 1834, and 1838.
[10] The Mechanical Principles of Engineering and Architecture. By the Rev. H. Moseley, M.A. 8vo. Longman and Co. 1843.
[11] Ibid. pp. 138, 139.
[12] Phil. Trans., 1785, p. 165.
[13] Treatise on Railroads, 3rd Edit. p. 396, et seq.
[14] Ibid., p. 355.
[15] Mechanics, 1769. Prop. 62.
[16] Outlines of Nat. Phil., 1834, Art. 159.
[17] Treatise on Railroads, 1825, p. 46.
[18] Math. Dict., Art. Friction.
[19] Library of Useful Knowledge, Mechanics, 3rd Treatise, Art. 7.
[20] Treatise on the Steam Engine, 1827, p. 60,
[21] Treatise on Locomotive Engines, 1840, chap. viii.
[22] Traité de Mécanique, 1833, Art. 456.
[23] Mechanical Philosophy, 1836, Art. 118.
[24] The Mechanics of Engineering, 1841, Art. 101.
[25] Mechanical Principles of Engineering, 1843, Art. 133, and Part 3rd, passim.
[26] Gregory's Mechanics, vol. ii, p. 25.

5th. A set of three-throw pumps, 5 inches in diameter, raising 80 barrels per hour, to a height of 54 feet, = 1 horse.

By calculation, as before, the friction amounted to $12\frac{1}{2}$ per cent.

6th. A set of three-throw "starting" pumps, pumping 250 barrels of beer per hour, to a height of 48 feet, = 4·87 horses.

By calculation as before, the friction amounted to $15\frac{1}{2}$ per cent.

7th. Two pair of iron rollers and an elevator, grinding and raising 40 quarters of malt per hour, = 8·5 horses.

8th. An ale-mashing machine, made by "Haigh," of Dublin; mashing at the time, 100 quarters of malt, = 5·68 horses.

9th. Two porter-mashing machines, made by "Moreland," mashing at the time, 250 quarters of malt, = 10·8 horses.

10th. 95 feet of horizontal "Archimedes screw," 15 inches diameter, and an elevator, conveying 40 quarters of malt per hour, to a height of 65 feet, = 3·13 horses.

Mr. Davison promised to continue these experiments, and to communicate the results to the Institution.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

March 7.—J. Shaw, Esq., in the Chair.

A paper "*On the contemplated Restoration of the beautiful Chapter House at Salisbury Cathedral,*" was read, by Mr. T. H. Wyatt, Architect to the Salisbury Diocesan Church Building Association, which is printed in full in the preseut number.

Mr. Ferrey read a paper "*On an old staircase at Tamworth Church which has fallen into decay.*" It is a sort of double corkscrew stair, winding in such a manner over each other, that two persons may go up and down without meeting, although both are circulating in the same well-hole. Mr. Ferrey offered some remarks as to its probable purpose. It is said to be a solitary instance of this exact kind of stair in England, but we remember to have seen one at Cologne.

April 3.—His Royal Highness Prince Albert, the Patron of the Institute, presided at a general meeting of the members, and presented the medals awarded during the session, for essays and drawings. His Royal Highness arrived punctually at the time appointed, attended by Colonel Bouverie; he was received by the Vice-Presidents, and the Honorary Secretaries, and conducted to the Library, where the other members of the Council being assembled, were severally presented. The Prince then presided at a Council, at which some ordinary routine business was transacted; and, subsequently, having inspected the various antiquities, casts and models in the collection, proceeded to the large room, where his Royal Highness took the chair, and the business of the day was commenced. The minutes having been read, and some donations announced, Mr. Donaldson, Foreign Secretary, read letters from Italian and French correspondents, at Milan, Coblentz, and Paris.

Mr. Fowler, Honorary Secretary, read Bacon's Description of a Princely Palace; and Mr. A. Johnson was presented to the Prince as the author of the best design founded on that description, and received the Soane medal. In like manner his Royal Highness presented to Mr. E. Chamberlain, of Leicester, the medal of the Institute, for his essay on the subject proposed, "*Are Synchronism and Uniformity of Style essential to beauty and propriety in Architecture;*" and to Mr. J. W. Papworth, the medal of merit, for an essay on the same subject.

Mr. Bailey announced the subjects for essays and drawings, for which the Council propose to offer the medals for the ensuing year, and then read a communication from Mr. C. Parker, "*On the modes usually adopted in forming Foundations in the city of Venice,*' the soil of which city is of a nature to require the greatest care, and yet where failure is seldom if ever seen.

At the conclusion of the proceedings Mr. Barry addressed the Prince in the name of the Institute, and expressed, in a few words, the grateful sense entertained by the members, of the honour conferred on the body by the gracious manner in which his Royal Highness had acceded to their wishes in presiding on the occasion: to which his Royal Highness very graciously replied, that he had felt much pleasure in taking part in the proceedings of the day.

THE NEW HOUSES OF PARLIAMENT.

The Commisioners on the fine arts, of which Prince Albert is the head, having called upon Mr. Barry, as architect, to furnish them with a report as to his views relating to the "internal decorations, additions to building, and local improvements," that gentleman transmitted his report to his Royal Highness and the Commission last month. Judging the subject as likely to inteiest our readers, especially as many of the suggestions offered by Mr. Barry will nndoubtedly be carried out, we place the following particulars of the proposed decorations, &c. before our readers, for which we are indebted to the *Morning Herald.*

"As presiding over her Majesty's commissioners for encouraging the fine arts in connection with the rebuilding of the new Houses of Parliament, I venture to address your Royal Highness, and, in compliance with the instructions of the commission, to offer the following suggestions relative to the internal finishings and decorations of the new Houses of Parliament, the completion of the exterior and local improvements, which are, in my opinion, necessary to give full effect to the new building; and by way of illustration of the remarks I have to make on these subjects, I beg to transmit the accompanying plan of the principal floor of the new building, a general plan of part of Westminster, in which the new building is shown in connection with various improvements proposed to be made in its locality, and two drawings relating to Westminster-bridge.

THE DECORATIONS.

"With reference to the interior of the new Houses of Parliament generally, I would suggest that the walls of the several halls, galleries, and corridors of approach, as well as the various public apartments throughout the building, should be decorated with paintings having reference to events in the history of the country; and that those paintings should be placed in compartments formed by such a suitable arrangement of the architectural designs of the interior as will best promote their effective union with the arts of sculpture and architecture. With this view, I should consider it to be of the utmost importance that the paintings should be wholly free from gloss on the surface, that they may be perfectly seen and fully understood from all points of view. That all other portions of the plain surfaces of the walls should be covered with suitable architectonic decoration, or diapered enrichment in colour, occasionally enlivened with gold, and blended with armorial bearings, badges, cognisances, and other heraldic insignia, emblazoned in their proper colours. That such of the halls as are groined should have their vaults decorated in a similar manner, with the addition occasionally of subjects or works of art so interwoven with the diapered ground as not to disturb the harmony or the effect of the architectural composition. That such of the ceilings as are flat should be formed into compartments by moulded ribs, enriched with carved heraldic and Tudor decorations. That those ceilings should be relieved by positive colour and gilding, and occasionally by gold grounds with diaper enrichments, legends, and heraldic devices in colour. That the screens, pillars, corbels, niches, dressings of the windows, and other architectural decorations, should be painted to harmonise with the paintings and diapered decorations of the walls generally, and be occasionally relieved with positive colour and gilding. That the door-jambs and fire-places should be constructed of British marbles of suitable quality and colour, highly polished, and occasionally relieved by colour and gilding in their mouldings and sculptural enrichments.

"That the floors of the several halls, galleries, and corridors should be formed of encaustic tiles, bearing heraldic decorations and other enrichments in colours, laid in margins and compartments, in combination with polished British marbles; and that the same description of marbles should also be employed for the steps of the several staircases.

"That the walls, to the height of from eight to ten feet, should be lined with oak framing, containing shields with armorial bearings emblazoned in their proper colours, and an oak seat should in all cases be placed against such framing. That the windows of the several halls, galleries, and corridors should be glazed doubly, for the purpose of tempering the light and preventing the direct rays of the sun from interfering with the effect of the internal decorations generally. For this purpose the outer glazing is proposed to be of ground glass, in single plates, and the inner glazing of an ornamental design in metal, filled with stained glass, bearing arms and other heraldic insignia in their proper colours; but so arranged as that the ground, which I should recommend to be of a warm yellowish tint, covered with a running foliage or diaper, and occasionally relieved by legends in black letter, should predominate, in order that so much light only may be excluded as may be thought desirable to do away with either a garish or cold effect upon the paintings and decorations generally. Practically, I consider that the double glazing will be of essential service in carrying out the system of warming and ventilating proposed to be adopted in the building generally; which system renders it unnecessary that the windows in those portions of the building above referred to should be made to open, so that all prejudicial effects upon the paintings and other decorations, which might be caused by the dampness and impurity of the atmosphere, and much practical inconvenience, and probably unsightliness in the means that would be necessary to adopt for opening and shutting casements would be avoided.

"That, in order to promote the art of sculpture, and its effective union with painting and architecture, I would propose that in the halls, galleries, and corridors, statues might be employed for the purpose of dividing the paintings on the walls. By this arrangement a rich effect of perspective, and a due subordination of the several arts to each other would be obtained. The statues suggested should, in my opinion, be of marble, of the colour of polished alabaster, and be raised upon lofty and suitable pedestals, placed close to the wall, in niches, surmounted by enriched canopies; but the niches should be shallow, so that the statues may be as well seen laterally as in front.

"The architectural decorations of these niches might be painted of such colours as will give the best effect to the adjoining paintings, being relieved in parts by positive colour and gilding; and the backs of them might be painted in dark colours, such as chocolate, crimson, or blue, or they might be of gold, for the purpose of giving effect to the statues.

"Having thus described the views I entertain as to the character of the decorations of the interior generally, I now proceed to notice in detail the special decorations and arrangements which I would propose for the several halls, galleries, and principal apartments.

WESTMINSTER HALL.

"I would propose that Westminster Hall, which is 239 feet long, 68 feet wide, and 90 feet high, should be made the depository, as in former times, for all trophies obtained in wars with foreign nations. These trophies might be so arranged above the paintings on the walls and in the roof as to have a very striking and interesting effect.

"I would further suggest that pedestals, 20 in number, answering to the position of the principal ribs of the roof, should be placed so as to form a central avenue, 30 feet wide, from the north entrance door to St. Stephen's porch, for statues of the most celebrated British statesmen, whose public services have been commemorated by monuments erected at the public expense, as well as for present and future statesmen whose services may be considered by Parliament to merit a similar tribute to their memories.

"The statues (26 in number) which have already been proposed to be placed against the walls, between the pictures, I would suggest should be those of naval and military commanders.

"The subjects of the paintings on the walls, 28 in number, 16 feet in length and 10 feet in height, might relate to the most splendid warlike achievements of English history, both by sea and by land, which, as well as the statues that are proposed to divide them, might be arranged chronologically.

"To give due effect to those suggested decorations, it is proposed that the light should be considerably increased by an enlargement of the dormer windows in the roof, by which also that extraordinary and beautiful piece of decorative carpentry of the 14th century may be seen to much greater advantage than has ever yet been the case.

"This noble hall, certainly the most splendid in its style in the world, thus decorated by the union of painting, sculpture, and architecture, and aided by the arts of decoration as suggested, it is presumed would present a most striking appearance, and be an object of great national interest.

ST. STEPHEN'S HALL.

"I would suggest that this hall, which will be 90 feet long, 30 feet wide and 50 feet high, and have a stone-groined ceiling, should be appropriated to the reception of paintings, commemorative of great domestic events in British history, and statues of celebrated statesmen in past, present, and future times. The paintings may be 10 in number, 15 feet long and 10 feet high, and 12 statues would be required as a frame to them. In the upper part of the hall, 30 niches will be provided for statues of eminent men of the naval, military, and civil services of the country.

THE CENTRAL HALL.

"This hall will be an octagon of 60 feet in diameter, and 50 feet high, covered with a groined ceiling in stone. As each side will be wholly occupied with windows, and arched openings of access, paintings cannot form any part of its decoration. It may, however, with good effect, be extensively decorated with sculpture. In the centre of the pavement might be placed a statue of her present Most Gracious Majesty, upon a rich pedestal of British marble, highly polished, and relieved in parts by gold and colour. The niches in the walls and screens might be filled with statues of her Majesty's ancestors, in chronological order, even up to the period of the Heptarchy. In front of the eight clustered pillars in the angles of the hall, might be placed, with good effect, sedent statues of some of the great lawgivers of antiquity.

THE VICTORIA GALLERY.

"This gallery will be 130 feet long, 45 feet wide, and 50 feet high, with a flat ceiling, and will admit of both paintings and sculpture. The subjects of the paintings on the walls, 16 in number, which may be 12 feet long and 10 feet high, might relate to some of the most remarkable royal pageants of British history or other appropriate subjects. Statues of her present Most Gracious Majesty might fill the central niches at the ends of the hall, and the other niches, as well as the pedestals between the paintings, might be occupied by statues of her Majesty's ancestors. These statues might, with good effect, be of bronze, either partially or wholly gilt.

CORRIDORS OF ACCESS THROUGHOUT THE BUILDING.

"The principal corridors of access to the various apartments of the building will be 12 feet wide, their ceilings will be flat, and they will be generally lighted from windows near the ceiling. The walls may be decorated with portraits as well as paintings, illustrative of some of the most remarkable events in the history of the country, or in the lives of its most eminent personages. For this purpose about 2,600 feet in length of wall, by a height of about seven feet, may be appropriated on the principal floor: 900 feet in length, by a height of about seven feet on the one-pair floor; and about 400 feet, by the same height, on the two-pair floor. These paintings may be divided into subjects at pleasure, by margins or borders of architectonic decoration in accordance with the style of the building.

THE HOUSE OF LORDS.

"This house will be 93 feet long, 45 feet wide, and 50 feet high, will have a flat ceiling in panels. As the fittings for the accommodation required for the business of the house, together with the windows, which are necessary for duly lighting it, leave little space of plain wall, paintings cannot, with good effect, form any part of its decoration. Niches, however, will be provided, which might be filled with statues of royal personages. The architectural details of the ceiling may be enriched and relieved with gold and colour, and the windows filled with stained glass as before described. The whole of the fittings are proposed to be of oak, with appropriate carvings. The throne will be highly enriched and relieved by colour and gilding, and the back lined with cloth of gold, containing the royal arms emblazoned in colours.

THE HOUSE OF COMMONS.

"This house will be 83 feet long, 46 feet wide, and 50 feet high, and will have a flat ceiling. It is proposed to be finished in the same style as the House of Lords, but with less enrichment, and less of colour and gold in its decorations. The nature of its designs, and the extent of its fittings for the accommodations required, will not admit of either painting or sculpture.

THE QUEEN'S ROBING-ROOM.

"This room will be 38 feet long, 35 feet wide, and 20 feet high, and have a flat ceiling in panels, richly moulded and carved, and relieved with gold and colour. The ground of the panels of the ceiling is proposed to be of gold, covered with a diaper enrichment, and blended with legends, genealogical devices, badges, cognisances, and other heraldic insignia, and in colour.

"The wall-fittings of the room are proposed to be of oak, richly carved and moulded, and enriched with heraldic and other decorations in positive colour, relieved with gold. Compartments will be formed in the wall-framing, which might be filled with paintings referring to events in British history in which the Sovereign has personally taken a conspicuous part, or with other appropriate subjects.

THE ANTI-ROOM, OR GUARD-ROOM.

"This room which adjoins the Queen's robing-room, will be 38 feet by 38 feet, and 20 feet high. The ceiling will be of oak, with characteristic decorations. Oak framing, eight feet high, with heraldic decorations, and a seat at the foot of it, will line the room. The walls are proposed to be covered with representations of battle-scenes, and pageants of English history, in which an opportunity would be afforded of displaying the warlike costumes of its several periods.

THE CONFERENCE HALL.

"This hall, which is in the centre of the front towards the river, will be 54 feet long, 28 feet wide, and 20 feet high, and will have a flat ceiling. The walls are proposed to be lined with oak framing to the height of about 6 feet, above which they might be covered with paintings representing celebrated state trials, and extraordinary sittings of Parliament, conferences, &c.

AS TO THE APARTMENTS APPROPRIATED TO THE PRIVATE AND PUBLIC USES OF EACH HOUSE.

"These rooms consist of libraries, refreshment rooms, robing rooms, state officers' rooms, and committee rooms.

"Nine rooms are appropriated to libraries, six of which are fifty feet long, and 28 feet wide; two are 33 feet long, and 28 feet wide; and one is 32 feet long, and 23 feet wide. The refreshment rooms are four in number, of which one is 60 feet long and 18 feet wide; two are 28 feet long and 18 feet wide; and one is 34 feet long and 18 feet wide. The robing rooms for the archbishops and bishops are three in number, of the respective sizes of 30 feet by 20 feet, 20 feet square and 16 feet square. The robing and other rooms for state officers are seventeen in number, averaging in size about 24 feet by 18 feet. The committee rooms are thirty-five in number. On the principal floor, five of them will be 37 feet long by 28 feet wide; two 35 feet by 26 feet; and one 32 feet by 23 feet. On the one-pair floor, two will be 42 feet long and 33 feet wide; one 54 feet by 28 feet; four 36 feet by 28 feet; ten 34 feet by 28 feet; and two 34 feet by 22 feet; and on the two-pair floor the number will be eight, averaging in size 28 feet by 20 feet. The whole of these rooms are about 20 feet in height, with the exception of those on the two-pair floor, which will be about 14 feet high, and will be lighted by windows of the usual height from the floor.

"The ceilings will be flat and formed into panels by moulded and carved ribs, relieved by characteristic and suitable carvings.

"The floors are to be of oak, with borders and inlays.

"The fire places and door jambs are proposed to be of British marbles, highly polished. The doors, frontispieces, linings of walls, and fittings, will also be of oak. In some of the rooms it is proposed that the wall framing should be carried to the height of six or eight feet, in others that it should be of the full height of the room, and with panels for paintings, portraits, &c.

"The plain surfaces of the walls might be covered with paintings of historical events, and the panels in the wainscoting might contain portraits of celebrated personages in British history.

"The architectural details, both in stone and plaster, might be painted in positive colours, occasionally relieved with gilding: and the armorial bearings, badges, and other heraldic insignia which will enrich the wood-framing, might also be relieved with gold and colour.

THE SPEAKER'S RESIDENCE.

"This residence, being designed for state purposes, might also be adorned with paintings. The style of its finishings, fittings and decorations will be in accordance with the best examples of the Tudor period.

"Its principal rooms for the purposes of state are as follows:—A reception-room, 34 feet by 23 feet; a library, 34 feet by 23 feet; a dining-room, 45 feet by 24 feet; a drawing-room, 38 feet by 22 feet; and a corridor of communication, 8 feet wide, surrounding an internal court.

"With respect to any further encouragement of the fine arts in the exterior of the building, I am not aware of any opportunities that offer, as arrangements have already been made for all the architectonic or conventional sculpture that will be required to adorn the several elevations. Equestrian statues of sovereigns in bronze might, however, be placed with considerable effect in the proposed quadrangle of New Palace-yard, the Speaker's quadrangle, and the royal court.

"I have now described, in general terms the whole of those portions of the building that might, I think, with propriety and effect be adorned with works of art, and the arts of decoration; but in making the several suggestions which have occurred to me, I should wish it to be understood that I have merely stated my own views on the subject, as far as I have hitherto been able to consider it in its general bearings, and with a view to show how the objects for which the commission has been established may, if desired, be carried out in the decorations of the new building to their greatest extent. I should not however, wish to be strictly confined in all cases to the adoption of even my own suggestions, as upon a more mature consideration of the subject in detail hereafter, when the shell of the building is completed, I may be induced to vary and modify some of the views which I entertain at present, and which, I fear, I have but imperfectly communicated in this paper.

AS TO THE COMPLETION OF THE EXTERIOR.

"It has ever been considered by me a great defect in my design for the new Houses of Parliament that it does not comprise a front of sufficient length towards the Abbey, particularly as the building will be better and more generally seen on that side than any other. This was impossible, owing to the broken outline of the site with which I had to deal. I propose, therefore, that an addition should be made to the building for the purpose of enclosing new Palace-yard, and thus of obtaining the desired front. This addition would be in accordance with the plan of the ancient palace of Westminster, in which the hall was formerly placed in a quadrangle, where, in consequence of its low level, it must have been seen and approached, as it would be, under such circumstances, to the best advantage. The proposed addition would, in my opinion, be of considerable importance as regards the increased accommodation and convenience that it would afford in addition to what is already provided for in the new building as hitherto proposed.

"It has long been a subject of serious complaint and reproach that the present law courts are most inconveniently restricted in their arrangements and accommodation. If it should be determined to retain the courts at Westminster, the proposed addition would admit of the means of removing this cause of complaint; it would also afford accommodation for places of refreshment for the public, for which no provision has been made in the new building, also for royal commissions and other occasional purposes required by Government, and now hired most inconveniently, in various parts of the town, at a considerable amount of rental; or for such of the Government offices as may, without inconvenience, be detached from the rest, such as, for instance, the office of woods, or for a record office, and chambers or residences for public officers. It will also afford the opportunity of making an imposing principal entrance to the entire edifice at the angle of Bridge-street and St. Margaret-street—a feature which is at present required, and which would add considerably, not only to the effect of the building, but also to its security in times of public commotion.

"Of the several local improvements suggested, none, in my opinion, is of greater or more pressing importance than that which I have to suggest in respect to Westminster-bridge. The anomaly of the size, outline, and character of that bridge, considered, as it ever must be from its proximity, as an adjunct to the new Houses of Parliament, must have forcibly struck every one who has passed over or under it since the new building has risen into importance; and the steep and dangerous declivities of the roadway, as well as its want of width for the traffic that passes over it, have constantly been a subject of public complaint.

"In order, therefore, to remove these serious objections, I propose that the superstructure of the bridge should be rebuilt upon the old foundations, which are now in course of being repaired and extended under the able superintendence of Messrs. Walker and Burgess. As it is, in my opinion, of the utmost importance, both as regards the effect of the new Houses of Parliament when viewed from the bridge, and the convenience of the public in passing over it, that the roadway should be made on the *lowest possible level*, I would recommend that the form of the arches of the new bridge should be pointed, by which great facility would be afforded for the accomplishing that very important object, namely, by materially reducing the thickness of the crown of the arches within what is considered necessary for arches of the circular form. I am induced also to recommend this form of arch on account of another very important practical advantage which it offers, namely, the elevation of its springing above the level of high water, by which the water-way through the bridge will be the same at all times of tide; whereas at present the spandrels of the arches offer an impediment to the water-way at high water nearly equal to 1-20th of its sectional area, occasioning rapid currents, with a considerable fall, and sometimes much danger to craft in passing through the bridge, under the influence of high winds. I consider it also of the greatest importance in an artistic point of view, not only that the bridge should be materially lowered, but that it should be made to accord with the new Houses of Parliament, in order that both in composition as well as style the *ensemble* should be harmonious and effective. Upon a rough estimate which I have formed of the cost of the new superstructure, I am satisfied it could be erected for about £120,000 beyond the cost it will be necessary to incur to carry out Messrs. Walker and Burgess's design for widening the present bridge to the extent proposed."

Mr. Barry, in continuation observes, it is clearly to be understood he has no desire to interfere with the employment of the engineers who are now engaged in the repair and extension of the foundations, whom he strongly recommends should be left to complete it. He expresses a hope that the commissioners, if they should think fit, will at their earliest convenience make a formal and urgent communication to the Government in accordance with the above views he has laid before them, as an early decision would be of great importance, in order that the works in hand may not be proceeded with farther than is necessary to carry out those views if they should be ultimately adopted.

The embankment on both sides of the river, from Vauxhall-bridge to London-bridge, he considers next in importance to the rebuilding of the superstructure of Westminster-bridge. He says:—

"As there would, doubtless, be serious objections to a public road upon the embankment on the north side of the river, I confine my observations to the southern side, where, if a road could be obtained, it would afford a succession of fine views of London, and the best situation for views of the principal front of the new houses of Parliament. Having maturely considered the subject, I think it would be practicable to obtain a public road of ample width upon arches, from the termini of the South-Eastern and Dover and the Brighton Railroads, at the foot of London-bridge to the terminus of the South-Western railway at Vauxhall.

"The road might be raised upon arches to a level that would coincide with the levels of the roadway of the several bridges which it would intersect, by which means the water-side frontages of the several wharfs need not be interfered with in any material degree; indeed, the extent of such frontages might, by the means of docks of convenient form and size, be very considerably increased, and the archways might, to a great extent, be appropriated, if desired, to warehouses and other purposes of trade. By extending the archways to a sufficient depth to the south of this road, a frontage for building might also be obtained, particularly opposite Privy Gardens and the new Houses of Parliament, where, if the houses were designed in masses, with reference to architectural effect, they would form an agreeable and striking view from the north side of the river, and effectually screen the present low and mean display of unpicturesque buildings on the Surrey side. The proposed houses, from being raised to a considerable elevation, would have a fine command of the river, and the principal public buildings of the metropolis, and having, in addition to these advantages, a southern aspect, would form very agreeable residences, such as would probably be eagerly sought for by the owners of adjoining wharfs, either for their own occupation, or that of their principal agents. Taking into consideration the private accommodation to the several wharfs, and the value of the new building frontage, the proposed work would probably yield a very considerable return for the capital expended upon it, and, when effected, would not only form one of the most striking improvements of an ornamental character of which the metropolis is susceptible, but would materially conduce to the convenience, the comfort, and the recreation of the public. It would also perhaps render unnecessary the line of road that has been projected from the termini of the railroads at the foot of London-bridge, through Southwark to the foot of Westminster-bridge, for the convenience of the west end of the town, as the distance to that part of London would be materially shortened by taking the proposed embankment road, and passing over Waterloo-bridge."

Of the local improvements immediately contiguous to the new Houses of Parliament and the approaches, Mr. Barry in continuation remarks:—

"Old Palace-yard is proposed to be considerably increased in size by the demolition of the houses which now occupy that site, as well as the houses on both sides of Abingdon-street, by which means a fine area for the convenience of state processions, and the carriages of peers and others attending the House of Lords, as well as a spacious landing-place adjoining the river, would be obtained. The Victoria Tower, as well as the south and west fronts of the building, would thus be displayed to the best advantage. The Chapter house would be laid open to public view, and if restored, would form a striking feature in conjunction with the Abbey; and a considerable extent of new building frontage that would be obtained by this alteration might be occupied by houses of importance, in a style of architecture in harmony with the Abbey and the new Houses of Parliament, by which a grand and imposing effect as a whole would be produced. As one means of improving the approaches I propose that the noble width of street at Whitehall should be extended southwards by the removal of the houses between Parliament-street and King-street, by which the Abbey would be wholly exposed to view as far as Whitehall Chapel. The houses on the north side of King-street should be removed for the purpose of substituting houses or public buildings—if required, of an improving style of architecture.

"Millbank Street is proposed to be widened and improved in order to make it a convenient and effective approach from Millbank Road to the Victoria Tower and Old Palace Yard. Tothill Street is also proposed to be widened and improved in order that it may be made an equally convenient and striking approach to the Abbey, the Houses of Parliament and Whitehall from the west-end of the town. St. Margaret's Church, if suffered to remain in its present position should be improved in its external decoration, in order that it may not disgrace, as it now does, the noble pile of the Abbey, which rises above it."

Mr. Barry concludes the enumeration of all the principal improvements he judges to prove most effective to the building on which he is engaged, by the hope, although some might be considered impracticable, that at no distant period the rebuilding of the superstructure, the embankments of the river, the enclosure of New Palace Yard, and the enlargement of Old Palace Yard, may be accomplished as "improvements of the utmost importance, whether as regards the beauty of the metropolis, the effect of the new Houses of Parliament, or the convenience, as well as the enjoyment of the public."

THE IPSWICH COMPETITION AND IPSWICH CUSTOM-HOUSE.

Sir—Notwithstanding that so very much has been said on the subject of competition generally, and also in regard to particular cases of it, never has a more striking proof of the manner in which such matters are *managed*, been brought forward, than that furnished by the competition now in progress for a new Custom-House at Ipswich. This I think will be admitted by every one on reading the following statement and correspondence, for which I solicit insertion in your *Journal*, in order that the profession and the public may be acquainted with the whole affair, and clearly perceive how monstrously absurd are the so-called "Instructions to Architects," sometimes put forth on such occasions. No doubt this Ipswich affair is a very trumpery one in every meaning of the word—most remarkably so; and on that very account does it call for strong animadversion and exposure; since it is owing to so many things of the kind being quietly passed over, as too insignificant for notice, or because it is worth no one's while in particular to make any "fuss" about them, that they at length become an established system. Silence on the part of the profession looks like acquiescence, and local "committees," relieved from the wholesome fear of committing themselves, perfectly irresponsible to public opinion, and at liberty to act just as they please, no matter how capriciously, how arbitrarily, or how absurdly. Bodies of that kind have, like private individuals, most unquestionably the right of pleasing themselves—that is, if they can, and also that of serving their own particular views and their own particular friends; but then it should be done in a different manner: for when they invite to competition by *public advertisement*, they become pledged to perfect fair dealing and impartiality, and bound to act with something like discretion. At all events, it may be supposed that they themselves have a tolerably distinct notion of what it is they do want, and ought, accordingly to express it as distinctly as they can: otherwise, the vagueness of their "instructions," either betrays their own incapacity, their inability to explain themselves in the first instance, and therefore, it may be inferred, their incompetence to judge afterwards on the designs admitted to them, or it very naturally excites a suspicion that all is not quite so fair and straightforward as it professes to be, but that the "instructions" have been conveniently mystified, in order not to enlighten people too much on the subject. Obscurity, we are told, is one source of the sublime; and if so, the committees who preside over competitions must be some of the sublimest people in the world.

One motive for my thus bringing forward this Ipswich affair, is the hope that the attention of the Institute of British Architects will now be called to it. It certainly is what it ought to take up; but although I belong to that body myself, I must own that it has hitherto shown itself by far too supine in all such matters: it is sadly deficient in that heartiness and zeal which, only exerted, would correct many abuses, and would no less directly than essentially benefit both the act and the profession. It ought not to leave to individuals in the latter, the onerous and not particularly gracious task of trying to effect what it is beyond the power of individual zeal and energy, however well directed to accomplish. The Institute, it may be presumed, possesses a certain degree of authority with public opinion: if so, let it exert that authority to some purpose, and beneficially. Let it convince the public that it is something more than a mere name, and that its influence extends beyond the walls of its own council-room. Unfortunately, however, those who have most weight and influence there, are least of all interested in bringing forward or promoting measures having for their object the interests of architecture and of the profession generally. That such should be the case is, perhaps, natural enough: why should those who are not at all personally affected by them, give themselves any concern about grievances and abuses which they do not feel, heavily as they may press upon and depress those who have to contend with them? The tranquility with which they view—for hardly can they be ignorant of them, may look like philosophy—like Mahommedan assignment to unavoidable evils; yet though their indifference may be very justifiable, all very prudent and proper, it certainly says nothing for their zeal, their generosity, or their public spirit; nor does it at all tend to raise the character of the Institute as a body in public estimation. *Tout au contraire*, it exposes it to animadversions all the more severe, because well merited. Perhaps I am now expressing myself rather strongly, and may besides be thought to spin out these remarks too largely, for I began them merely by way of preface to what follows, and to what I will now let follow at once without any further comment. "———"

"Instructions to Architects desirous of submitting designs for the proposed New Custom House, Ipswich, Suffolk.

"*To Architects.*

"The Corporation of Ipswich, propose to erect a public building upon the common quay, in that town, as a Custom-house and Excise-office; to comprise also, suitable offices for the accountant and collector of the dock commissioners, and other public business of the town connected with the mercantile and shipping interests; accommodation will also be required for the lessees or occupiers of the common quay wharf, which is the principal landing place for goods in the town, and any spare rooms may be adapted for private offices or a bonding warehouse.

"Cost.—The expenditure not to exceed £4000.

"Premiums.—Twenty guineas will be given for the first selected plan, and ten guineas for the second. Such two plans to become the property of the corporation. The architect whose design is selected will most probably be employed to superintend the erection of the building, provided he can produce satisfactory testimonials as to his ability, &c.

"Site.—The site for the proposed building is an open space, measuring about 240 feet by 130 feet, with a water frontage.

"Motto.—The different drawings, &c., are to be distinguished by a motto, and the name and address of each architect to be sealed up in an envelope bearing the same motto as his design, which letter will be returned, unopened, to the unsuccessful competitors.

"The plans, &c., to be delivered at the town clerk's office, Ipswich, on or before the 1st of May next. The selection of the premium designs will be duly advertised in the local papers, after which, the remaining designs will be returned to their respective authors, on their writing for the same, stating the motto affixed to their various drawings, &c.

"S. A. Nolcutt, Jun.,
"Town Clerk.

"Ipswich, March 1843."

"11th April, 1843.

"Sir—I shall feel obliged by your favouring me with replies to the following queries relative to the competition for the new Customhouse, Ipswich.

"1st. Is it necessary for the competitor to see the ground previously to preparing his desings?

"2nd. What is the nature of the foundation? will it be requisite to use piling or concrete, or is the natural soil sufficiently solid to bear the ordinary foundations of a building of the size and nature required, without any extraordinary outlay for this part of the work?

"3rd. What accommodation will be required for the Custom-house and Excise-office, and what dimensions will be required for the rooms?

"4th. What is to be understood by 'suitable offices for the accountant and collector of the dock commissioners;' are there two or more rooms: and about what dimensions will they be required?

"5th. What accommodation will be required for the 'lessees or occupiers of the common quay wharf?'

"6th. What spare rooms are expected to be provided for offices and bonding warehouse, and what dimensions are they required to be?

"7th. Are all the rooms, warehouses, &c., contained in the first paragraph of the 'Instructions to architects,' to be included in the expenditure of £4000?

"8th. What distance is the wharf or water from the site of the proposed building

"9th. For the premiums, is it expected that the architects should furnish the *requisite number of drawings* in order that the corporation may form a just decision on the comparative merits of the various designs? Will it be necessary that they furnish the following? viz.

"Elevations of the four fronts; plans of the different stories, foundations and roofs; six or seven drawings; one longitudinal and two or three transverse sections; one or two perspective views, about 16 drawings; a specification of the work and a detailed estimate of the cost.

"10. What scale are the designs to be drawn to?

"11. Are the elevations to be coloured, tinted in the sepia or only to be drawn in outline?

"12. Are the perspective views to be taken from any fixed points? And are they to be coloured or tinted in sepia?

"13. What materials are to be used in the construction of the outside walls, and in whatever decoration the limited funds will allow?

"14. As the architect whose design is approved will '*most probably*' be employed to erect the building, may I ask if any designs have been laid before the corporation previously to the competition being proposed?

"15. Have the corporation an architect, or any one possessing a knowledge of architecture in their employ?

"16. Will any means be adopted to ascertain that the designs can be executed for the sums estimated?

"17. Will the corporation undertake to lay aside all designs which cannot be executed for the sums estimated?

"18. By whom are the designs to be examined and selected?

"19. Are the parties who examine and select the designs well acquainted with the principles of composition in architecture, as regards unity of style, fitness for the end in view, and harmony to which I may add the principles of construction, and the proper application of materials?

"20. Is the approved design to be in strict conformity to ancient precedent, or to be an original composition, possessing all the requisites of a work of fine art?

"21. In case the corporation should consider it necessary to call in the aid of a professional architect to assist them in the selection of the designs, will his report be delivered in writing, and will it be published or otherwise be made known to the competitors, in order that they may have an opportunity of reflecting any opinion therein contained?

"22. The time for sending the designs is exceedingly limited. It would be of considerable benefit to the corporation as well as the architects that a greater length of time was allowed for preparing the design; can the corporation grant such a request?

"23. Is it intended that the designs should be publicly exhibited previously to the decision of the corporation?

"24. Who are the members of the corporation that are to form the judges in the competition?

"I have to apologize for taking up so much of your time; but without the information herein required it will be impossible to furnish suitable designs for the proposed building.

"Your earliest reply will oblige,

"Yours, &c.,

"———."

"Ipswich, 13th April, 1843.

"Sir—I have your letter of yesterday. It is quite impossible for me to give the answers you require. £4000 is the total sum to be expended. The dock commissioners would only require two rooms, and these not large. The architect may choose the site of the building in the area, the dimensions of which are furnished in the paper already sent to you, except that a roadway of 30 feet from the water's edge must be left free of any building. There is no limit as to scale. The time for sending in drawings cannot be extended.

"I am, Sir,

"Your obedient humble servant,

"S. A. Nolcutt, Jun."

"14th April, 1843.

"Sir—I am exceedingly sorry to be so troublesome to you, but without the requisite data, it is impossible for any architect to prepare suitable designs for the Custom-house at Ipswich. If it is impossible for you to give me the information required, you may probably inform me to whom I am to apply. In the printed instructions to architects, there is so little information, that the whole accomodation required for the Custom-house is quite undefined; and whether the offices are for one or two clerks or more persons is not mentioned. I respectfully submit that the architect's answers to the queries I sent on the 11th instant should be given by the committee, who of course are fully aware of the accommodation they require. I shall feel obliged by an early reply.

"I am, &c.,

"———."

"Ipswich, 15th April, 1843.

"Sir—I have to acknowledge the receipt of your letter of the 14th, and regret that I can afford little more information than has been already furnished to you in common with those gentlemen who have stated their determination to send in plans for the new Custom-house here.

"I can only say, generally, that the business of the port in both departments, custom and excise, is not likely to be very considerable, and the dock commissioners would not require more than a couple of moderate sized rooms. The limited expenditure must of course govern the extent of the accommodation.

"I am, Sir,

"Your obedient humble servant,

"S. A. Nolcutt, Jun."

"17th April.

"Sir—I should be wrong in expressing an opinion that the corporation of Ipswich were the only body who have published such vague instructions, when they require architects to prepare certain designs for the buildings they have it in contemplation to erect; was this the first instance of the kind, little could be said upon the subject, but as it is now the usual proceeding in most occasions of this nature, the profession, as a body, ought to complain; yet us a body, they do little, it therefore rests with individuals to do something.

"I would not for a moment suppose that the corporation have already decided who is to be the architect of the building, nor do I suppose that each member of that body has his particular friend to support, and therefore all the information he possesses is necessarily reserved for this friend, I say I cannot presume that this is the case, but the very great difficulty I have experienced in obtaining the *necessary* information so as to prepare the required designs, naturally creates a suspicion, especially as the numerous results of such proceedings confirm those suspicions. I presumed, when I wrote to you, that officially you had the power of answering all necessary questions, and that if you had not such power, at least you could direct me to some person who must have known what was required, better than a stranger, for the commercial business of the port. The dock commissioners, the accountant, the merchants, who are interested in the shipping, the occupiers of the common quay wharfs, the town clerk, and others interested or connected with the custom house, must individually have some idea of the accommodation; surely it would have been no great or difficult task to collect such information, in order that the corporation should get the *most suitable* design for their building—or if they do not know what they want, they can want nothing—this is a natural inference, and perhaps the least requiring an apology.

"I have to thank you for your letters, although you were unable to give me the information I required. It is my intention to publish in some periodical, the 'Instructions to Archiects,' my queries, and the correspondence I have had with you on this occasion, my only wish being to obtain, in business of this nature, all the information that the subject may require, and in which I have been so unsuccessful in this instance.

"The most extraordinary thing in this competition appears to me to be that the corporation are to select the most suitable design for their building, yet admit through their official organ, that they do not known what is required, at least I must come to this conclusion, as the information I required on the most important subjects could not be obtained.

"I am, &c.,

"———."

South-Eastern Railway—(Folkstone.)—The works at this place are rapidly progressing under the contractors for the works, Messrs. Grissell and Peto, who it is expected will be able to place the line soon in the hands of Mr. Betts, the contractor for the permanent way, and there is now no doubt that the line will be in operation within seven miles of Dover before the end of July next, neither now is there any doubt expressed as to which will be the direct line to France.

REVIEWS.

MR. PUGIN'S NEW WORK.

An Apology for the Revival of Christian Architecture in England. By A. WELBY PUGIN, Architect, Professor of Ecclesiastical Antiquities at St. Marie's College, Oscott. Small 4to., Ten Plates. London, 1843. Weale.

To recommend this production to the notice of our readers, would be almost superfluous, since it is one which can hardly by any possibility *escape* notice, or fail to obtain greater attention than usually falls to the lot of architectural publications in general, or even of such as have more than ordinary merit to recommend them. Any thing proceeding from the author of the "Contrasts" and "True Principles," is certain of being taken up with curiosity, and with not the least degree of it by those in whom that feeling may be more or less mixed with apprehension, and who are therefore anxious to discover whether they themselves come in for any remarks from a pen that is not always exercised very gently. In one respect, Mr. Pugin is quite alone, not only from all other architectural writers, but from nearly all other writers whatever; he is no respecter of persons, but speaks as one having authority—openly, boldly, without any observance of the *suaviter in modo*, without attempting to conciliate any one, and without caring what individuals he may offend. Mawkish liberality and excessive "good nature" are not among Mr. Pugin's foibles; so far is he from excusing himself upon grounds of "delicacy," and saying as little as possible in regard to living architects and their productions, that in speaking both of the one and the other, he goes to an extent quite unprecedented, except it be either in anonymous criticism, or hostile literary controversy. Neither is there any thing apologetic in his tone; he does not offer his opinions as merely those of an individual, but as positive and unquestionable dogmas, no less implicitly to be adopted than they are fearlessly proclaimed without the slightest misgiving on his part.

Whether it be altogether prudent or becoming in an individual, let his ability be what it may, to set himself up as a sort of oracle, and to assume a self-elected dictatorship over all the rest of the profession, is a point we leave others to settle. Be it either with or without "right," such is in a manner the case; nor have we to read far in his book before we find, that however unwarrantably it may have been usurped, Mr. Pugin is determined to exercise his office with a high hand. We do not know if this new volume of his is the same in substance with a series of architectural papers announced some time ago under his name, in the *Art Union*, but which never appeared. It is not altogether unlikely, for there certainly is much which not every editor would care to sanction; nor is Mr. Pugin a writer very submissive to editorial control, or disposed to expunge or qualify or soften down what may be objected to as offensive and unsafe opinions and expressions.

Like another Sir Huon, Mr. Pugin plucks a Sultan by his beard, the Sultan in this case being no other than the Professor—aye, the "living" Professor—of Architecture at the Royal Academy, whom he treats not at all more ceremoniously than he did Sir John Soane, when he showed up the "Professor's Own House." "It is a perfect disgrace to the Royal Academy," he says in a lengthy and piquant note, at his third page, "that its Professor of Architecture should be permitted to poison the minds of the students of that establishment by propagating his erroneous opinions of Christian architecture. The influence which his position naturally gives him over their minds is doubtless considerable, and the effect of his instructions proportionably pernicious. Not content, however, with the disparagement of ancient excellence, which he introduces in his official lectures, he is *practically carrying out* his contempt of pointed design in both Universities, and in a manner that must cause anguish of soul to any man of Catholic mind and feeling. The ancient buildings of King's College, models of perfection in their way, are actually being demolished in order to make room for a monstrous erection of mongrel Italian, a heavy, vulgar, unsightly mass, which already obscures, from some points, the lateral elevation of King's Chapel, and which it is impossible to view without a depression of spirits and feelings of disgust. A man who *paganizes* in the Universities deserves no quarter."!

We need not quote further, but may leave the remainder as a titbit in store for those who feel their curiosity wetted, by the "taste" we have given them of this formidable note, merely remarking here that it hints at "gin-palace design" at Oxford, and prophesies that those, and many other works of the present day, "will be the laughing stock of posterity." Still, though we are inclined to admit that the buildings Mr. Pugin so mercilessly reprobates are decidedly bad, yet not perhaps quite so much so as to occasion "anguish of soul," and actual "depression of spirits;" we consider them such, not because they are not of "pointed design," but because they are very tasteless and excessively poor in themselves—strangely crude and patched-up abortions, without any manifestation of study bestowed upon them, and egregiously defective, not only in regard to taste, but as buildings, and devoid of all unity of plan and composition. In falling foul of the professor for "paganizing" in the universities, Mr. Pugin is perhaps rather too severe, and somewhat unguarded, for there has been a good deal of "paganizing" elsewhere before now, and the example was set by the very fountain head of orthodoxy, the apostolic city, and by the very successors of St. Peter. The Vatican itself is most dreadfully and scandalously pagan; its galleries are a perfect rendezvous of heathenism. We are, therefore, at liberty to fancy that, although he has not had the candour to admit as much, Mr. Pugin devoutly damns "Leo's golden days," and the "paganism" of Popes and Cardinals, who, to make use of his own expressions, poisoned the minds of architects, artists, and students of all countries, by propagating erroneous opinions of Christian architecture and art. Certain it is that he could not point to that quarter, to Catholic Rome itself, as a model of Christian and Catholic purity, or else he would most assuredly have done so in the language of triumphant argument: whereas it may fairly be suspected, he is tolerably conscious that the less said on that head, and the more it is kept out of sight, the better, since he would, no doubt, be puzzled to reconcile the gross laxity of Rome, with his own rigorous ultra-Catholicism in architecture. Why, then, does he keep continually harping upon that string? why is he for ever taunting the profession and the public with a reproach which, however well deserved, and how great soever he may consider it to be, cannot possibly have any effect upon either? He tells them that architecture is no longer "the expression of our faith, or government, or country;" and they reply by laughing at him in his face, as a crack-brained enthusiast—an arrant Don Quixote, the champion *à l'outrance* of a chimerical Dulcinea. He lays by far too much stress on what are now regarded matters of perfect indifference, and not without reason so—on the mere externals and paraphernalia of religion, which both have been and are substituted for religion itself where not a particle of the latter exists. The attaching so much importance to the *costume* of devotion is dangerous, for it leads to a species of mummery and mountebankery which disgraces what it professes to honour.

It might be more discreet on the part of Mr. Pugin were he not to dwell so emphatically and so exclusively, on what forms the staple of his writings, and renders them quite as much polemical as architectural. Most certainly we should have been better satisfied had he obtruded upon us fewer of his religious opinions, and favoured us with something more in the shape of tangible criticism. Of the last we obtain but very little; it may, perhaps, be said to be in the "*pointed*" style—and so far appropriate enough: yet it is too bare and indiscriminate, and is in manner what would be termed downright verbiage and flippancy in a reviewer, or a magazine article. By denying all merit to, and endeavouring to convict of absurdity whatever does not belong to the only style of the art he is disposed to tolerate, he overshoots the mark altogether, and deprives his strictures of efficacy. He gives—at least leaves, us to understand, that our former English style is the only one at all suitable for us, and that all buildings in any other, are, without further inquiry into their merits, to be condemned as naught. The consequence is, the sweeping invective becomes a most harmless, if not inoffensive tirade: falling all alike, it affects no one in particular more than another, but leaves all, the best and ablest as well the most imbecile and the meanest, involved in the universal disgrace. So that the latter may even take consolation to themselves, by finding that their superiors are brought down to their own level, and made to appear just as incompetent as themselves.

With respect to Mr. Pugin's remarks on what has been done in architecture within the last twenty years, we do not complain so much of their severity and of want of patriotism, as of the indiscriminate censure manifested in them. It would seem, that all is bad alike—that is nothing for exception—that the Italian style is quite out of place in the Travellers' and Reform clubhouses, and treated without either propriety or *gusto*. We cannot, indeed, for a moment suppose that such is really Mr. Pugin's opinion—for in that case his opinion would be perfectly valueless, but what he says implies nearly as much, though he has reserved to himself the power of explaining a good deal of it away by saying that it is to be understood in a qualified and limited sense. At all events, what he does say, amounts to little more than the expression of uniform disapprobation: let him make what exceptions he may, he reserves those for the ear of his father confessor, who is not likely to divulge them. While, however, we agree with him that, notwithstanding the enormous sums they have cost, many of our public buildings are decided architectural failures, we are of opinion that the mischief is not so much to be attributed to the style adopted for them, as to the incompetence and want of artist-like feeling with which it has been treated. We are far also from believing that the style, so exclusively advocated by Mr. Pugin, would have been at all more appropriate or more efficacious, in the majority of the instances alluded to. The merely adopting a style does not confer genius; so far from it, that were we to judge of any particular one by the use which is made of it, we should be compelled to confess that the "pointed" is the most barbarous a balaam style conceivable, according to a great many modern samples of it.

Not content with advocating the claims of the pointed style for ecclesiastical and collegiate structures, Mr. Pugin seeks now to recommend it, exclusively of every other, for modern buildings of all kinds—for street architecture, dwelling houses and shops, although the specimens he gives are not at all calculated to enforce his arguments. Had any one else ventured to propose "Gothic" for shop fronts and windows, he might have been fancied to be quizzing. Nearly arrant masquerade in itself, such a system would tend to deteriorate the style most deplorably. Unless none but *artists* were employed, it would in a short time become a mere parody of the original—maimed, barbarous, and not to be beheld without "anguish of soul," by those who have any feeling for the original itself. No: the present negative style of our street architecture is infinitely preferable, inasmuch as no smell at all is better than a stink. Dull and monotonous as they are, the walls and holes in them for windows which form our streets, are preferable to what the author of the "Apology" recommends; there is no more to admire in them—no more design or variety than in the pavement itself, but there is also nothing to offend, nothing that solicits notice merely to disappoint and disgust.

There are, indeed, particular occasions where the pointed style might be applied, not only with propriety and consistency, but with admirable effect, although they have not been referred to by Mr. Pugin;—we mean, covered markets, and covered avenues of shops. For the former, an open timber roof would be perfectly in character, while a cloister gives us almost a direct model for a Gothic "arcade," requiring no further modification than as regards matters of detail. In such cases, while the design could be kept up consistently, without the slightest interference from individual fancies and caprices, there would be nothing to detract from or neutralize the effect of the ensemble—nothing to clash with it—nothing "over the way," altogether different in physiognomy to jar and jumble with it, in preposterous discord. For houses in the country, the Gothic style is sufficiently accommodating: they are generally built for the actual occupiers—at least for the family to whom they belong, and allow of greater study being bestowed upon them, and the style being properly kept up; but widely different is the case with houses built by wholesale as mere trading speculations. Supposing that indispensable detail, string-courses, copings, weather mouldings, &c., added nothing to the expense, and that carved decoration could be had for very little, yet family devices, heraldic ornaments, mottos and legends must be omitted, unless they could be changed with every change of tenant, since otherwise their incongruity—supposing such things to have any meaning at all, might occasionally prove more ludicrous than agreeable. We might further object that the lofty roof and gable shown in one of the specimens for domestic or street architecture at the present day, would be far from being any improvement upon the system of building now in vogue. Undoubtedly such things tend to give character externally, but then it is after a manner almost at direct variance with the normal principle laid down by Mr. Pugin himself—that every building should be natural, without disguise or concealment, and that nothing should be introduced that does not recommend itself by obvious propriety. It cannot, indeed, be said that in this case there is any disguise, yet there is surely the other error of loading a house with a steep roof—the rooms within which can evidently be but mere garrets—merely because it produces a better effect. Experience has taught that such pitch is quite unnecessary—at least for mere dwelling houses; therefore, to re-adopt it again, would be somewhat preposterous, since it is certainly attended with increased expense—and perhaps with no inconsiderable increase of danger too in case of fire, unless it be intended that iron should be substituted for timber, because otherwise the flames would quickly extend themselves along a whole range of lofty timber-framed roofs.

If such roofs therefore be, as Mr. Pugin will probably contend, so essential to the true character of the style, that it cannot be properly kept up without such feature, it then becomes a very natural question: "Why seek to bring into general use again a style which is so ill-accommodated to our actual wants and purposes, that it will not admit of being modified according to them?" We hardly know if we are to assume as a matter of course that it is intended the interior character should be in perfect keeping with the external elevations, and not only in regard to the architecture and fabric itself, but fittings-up and furniture. That is a point which Mr. Pugin passes over altogether, without giving us any kind of remark, instruction, or caution relative to it; and yet it is one which calls for them all, it being one in no small degree embarassing. It is true the Gordian knot may be easily cut through, by saying: so that the fronts be of antique and quaint physiognomy, no matter what the inside of the houses be;—they may be in any style, or no style at all. We cannot, however, even for a moment suppose that Mr. Pugin himself would consent to get over difficulties and objections in that way, since that would be converting his elevations into mere "*pointed masks*," and sham architecture. No one knows better than the author of the "Apology," that in order to have all in due keeping, furniture and fittings-up require quite as much study as the architecture itself—perhaps more, at least more research first, and contrivance afterwards, there being few models for our express guidance. No one is more alive to the absurdities and "monstrosities," foisted upon their customers, by cabinet-makers and upholsterers, under the name of "Gothic furniture," for he has indulged in a good deal of bitter pleasantry on the subject, in his "True Principles." Nevertheless, he now recommends what would inevitably lead to greater extravagances and absurdities of the kind; for if they have not been avoided where expense has been no consideration, where superior workmen have been employed, and where more than ordinary attention—albeit not directed by intelligence—has been bestowed, it is but reasonable to suppose that abominations still more flagrant would be perpetrated, were it attempted to render such style of furniture universal.

Important, however, as this portion of his subject is in itself, Mr. Pugin treats it so very summarily that all he says on it does not exceed our own comments, in length. We regret this, because we hoped to find and were curious to learn, how the pointed or old English style, could be peculiarly applicable to "civil architecture" generally, as the heading of the section led us to expect. It is a view of the matter, which while it has hardly been touched upon at all, affords a very wide field for remarks and critical inquiry; we are willing therefore to hope that Mr. Pugin will now pursue it much further, and give us an entire volume or separate essay upon that particular subject. We would further hint to him that his criticism partakes too much of mere assertion and opinion; and he, is withal, apt to bestow too much notice on downright paltrinesses which no one pretends to defend, or on minor defects. He complains for instance, that the kitchen court of Lambeth Palace, into which, it seems, he accidentally found his way, is not at all in keeping with the external elevations, the architect having there laid aside "his gothic *domino*;" whereas, in our opinion, it would have been far more to the purpose to examine the "gothic *domino*" itself, which most egregiously disappointed us when we first beheld it, for it is exceedingly *pale*,—passably enough correct, but deplorably spiritless and insipid.

We would further advise Mr. Pugin in future to give us less ding-dong about Catholicism and Protestantism. It looks as if the professed subject was made a mere "stalking horse" to something else: for aught we know, it may be all very good policy for himself, but hardly for his book. If he really expects to gain converts to his own creed, by any thing he can say in its favour, he must have as good a conceit of himself as the Quaker who undertook a journey to Rome, in the hope of converting the Pope. In his zeal for Catholicism, Mr. Pugin may be very sincere, but the world will not give him credit for being perfectly disinterested; therefore, it might be more discreet in him not to challenge in the manner he does, inquiry into his motives. There is besides no occasion for his going out of his direct and proper course, because that affords ample matter—more than he has on this occasion given consideration to. We shall always be happy to meet Mr. Pugin as an architectural writer; as a polemical one we can spare him, nor will all his pomp of words gain him one convert among Protestants, to "the the trumperies and mummeries" which he identifies with christian architecture, and with christianity itself.

Instruction in Drawing for the use of Elementary Schools. By Butler Williams, C.E., F.G.S., &c.

A Manual for Teaching Model Drawing from Solid Forms, combined with a Popular view of Perspective. By Butler Williams, C.E., F.G.S., &c. London: John W. Parker.

We have not space to enter into any lengthened notice of these works in the present journal, we can only now state, from a hasty glance at both volumes, that they appear to have been compiled with considerable care, and that much attention has been bestowed to render the teaching of drawing less irksome than is usually practised.

English Patents for 1842. By Andrew Pritchard, M.R.I. London: Whittaker and Co.

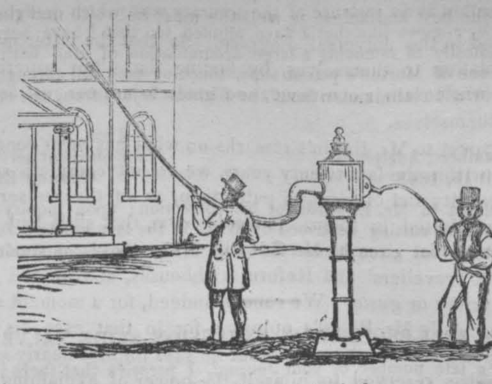
This useful work contains an alphabetical list of all the Patents, amounting to 7089, granted in England during the last year; there is also a classified index, and a concise account of the Law of Patents in Belgium.

Ancient Irish Pavement Tiles. By Thomas Oldham, A.B., F.G.S.S, L. & D., Dublin: John Robertson.

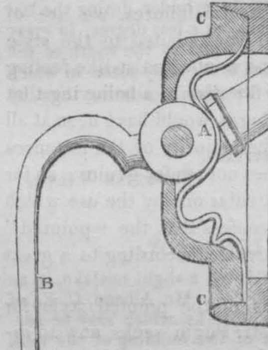
We have already noticed a work on Encaustic Tiles taken from examples in England, to this work the one before us forms an excellent companion, it contains no less than 32 patterns of tiles after the originals in Ireland, existing in St. Patrick's Cathedral, and Howth, Mellifont, and Newton Abbeys. Mr. Oldham, in his introductory remarks, informs us that there are three distinct kinds of Irish specimens—1st, Impressed; 2nd, Encaustic; and 3d, Tiles in Relief.

Turnpike Road through the Potteries.—This contract is let to Messrs. Bowers and Mondy, at about £2.500. The competition was so close that other parties were within fifteen pounds.

ROE'S IMPROVED PUMP.



The improvement consists in that part of the pump called the stuffing box, rendering such a box of no utility, and introducing in its stead a joint composed of leather, or any other flexible substance, such as indian rubber, cloth, webbing, &c. The material employed is cupped sufficiently large to allow the lever of the pump working the piston without any tension whatever taking place.



The joint, it will be perceived from the diagram, is fixed upon the side of the pump barrel, so that when a head is placed on the pump, the head forms an air vessel, and it becomes a powerful fire engine without any extra expense. A, the leather cup shown on section; B, the handle passing though it; C, C, the part by which the joint is secured to the pump barrel. For deep wells this is an invaluable invention, as it is impossible that any leakage can take place; and all acquainted with the common lift pump will at once see the importance of the improvement. By it, also, much labour is overcome, as in the old method in a very short time the rod works a large space in the packing, and much of the water flows back into the well, which, by the new method, is safely brought to the surface. A further important improvement is, that friction is by this means removed. Instead of the piston rod being screwed up tightly in the tow, &c., the rod works quite easily in the joint. One of these fire pumps we are informed has been fixed at St. James's Palace and another at the House of Commons.

DREDGING MACHINE.

Sir.—Perhaps you will allow me to make the following observations in your *Journal* with reference to a letter upon Dredging in your last number, by a person signing himself W. C. And which I think you will more readily do, as it appears to me you have yourself inadvertently misunderstood the improvement intended to be described by W. C.—

You state in your editorial remarks, that "in this *new process*, a lateral "sweep or circular motion is given to the ladder or bucket frame which "swings upon its *upper extremity as a centre*, and in its action imitates "that of a scythe in mowing, &c.;" whereas, *I* do not understand from W. C's. description that the bucket frame has any *such motion* with regard to the dredging machine, but that the whole engine moves radially; the length of the head rope (perhaps one or two hundred yards) being radius, and its anchor the centre of motion.—If I correctly understand W. C's. description, I have to observe that *this* is no new process at all, that this method was adopted at least 23 years ago by Mr. Cubitt (one of the vice presidents of the Institution of C. E.) in dredging a cut of considerable extent in the Ipswich river,[1] and since that time in a new and more complete dredging engine for the Norwich Navigation. The latter machine having been for some time past under my management, I can vouch for the excellence of its working, and I flatter myself that if W. C. had ever seen such an engine he would not have said that the civil engineer has made "no advancement in the working of the machine," a well arranged dredging machine being

[1] Whether this method was first introduced by this gentleman or not I do not know.

already to the civil engineer, what the planing machine is to the engine maker.

I will mention as an instance of the accuracy with which dredging *can* be performed by engines like that I have been in the habit periodically of removing a large accumulation of mud with it from the rails of one of Morton's patent slips, touching each rail throughout and leaving the whole clean, and without the slightest injury from one end to the other.

I am, Sir,
Your obedient servant,
York Chambers, Adelphi, April 15, 1843. GEORGE EDWARDS.

[We are obliged to Mr. Edwards for his correction; upon inquiry we find that the radius cutting described by W. C. in the last month's *Journal*, is the same as that given by Mr. Edwards in the above communication.—Editor.]

THE SELF-REGULATING EXPANSION SLIDE VALVE.

SIR—In a late number of your *Journal*, I perceive that there is a communication from Mr. H. H. Edwards, of a plan for working steam engines expansively, by means of a plate at the back of the slide valve, which is regulated in the extent of its motion, by means of arms worked by the governor. It is stated that when the plate is held fast by the arms, the steam will be cut off to the greatest extent. Now a very slight examination of the drawings will show that though the steam is cut off as soon as the port of the cylinder is half open, admitting steam during rather less than one-fourth of the stroke, yet on the return of the valve, the port will again be opened, and will allow the steam to pass into the cylinder during the last quarter of the stroke. The same will take place, in a less degree, in every position of the arms until they are at a distance equal to the width of the small ports from both ends of the plate, which is the only place in which they can be of any service, so that of course the plan of altering them by the governor fails.

I am, Sir,
Your obedient servant.
Glasgow, 18th April, 1843. THROTTLE VALVE.

FLAX MILL AT CASSANO, LOMBARDY.

SIR—I observe in your excellent number for April, a slight mistake, in an article headed—"Flax Mill at Cassano, Lombardy." Mr. Albano, C. E., of London, is therein stated to be the erector of the works, which may be correct, inasmuch as he was the superintendent of the building of the mill. The mechanical work, that is, the water-wheel and mill-gearing, were solely constructed and erected by Mr. Fairbairn, of Manchester; the greatest credit is therefore due to that eminent engineer in regard to the execution of the mechanical part. *Fiat justitia ruat cœlum.*

I am, Sir,
Your obedient servant,
London, Tuesday, April 4, 1842. S. N. S.

RESPONSIBILITY OF CONTRACTORS.

In the Court of Exchequer, Saturday, April 22, 1843.—Sittings in Banco at Westminster.

TOWNLEY, CLERK, V. COLEMAN.

The Attorney-General moved in this case for leave to enter the verdict for the defendant upon facts found by the award of the arbitrators to whom the cause had been referred, or to set aside that award, and for a new trial.

This was an action in which the plaintiff, who is a magistrate for the county of Norfolk, sought to recover damages on behalf of the county from the defendant, who is a builder, under the following circumstances:—The magistrates having determined to erect a bridge near Downham, procured certain plans from an eminent architect usually employed on such occasions, and then advertised for tenders. The defendant became the successful competitor for the job, and, according to the usual course, entered into a contract, to which were attached the plan and specifications. One of the covenants in this contract was, that the bridge should be finished within a specified time, and "kept in repair by the defendant for one year afterwards." When the bridge was completed, the architect and engineer certified that the work had been executed to their satisfaction, and the claim of the defendant was forthwith liquidated by the county treasurer. Little or no repairs were required at the hands of the builder during the early portion of the year, but towards its close the bridge gave symptoms of instability, and just before the expiration of the time, it fell in altogether. When called on to comply with his covenant, the defendant refused, on the ground that the failure of the bridge was not owing to the insufficiency of the work executed by him, but to the inherent vice of the original plan, which, as he averred, was of a nature altogether insufficient and vicious. Not satisfied with this, the present action was instituted, and having been referred to a learned gentleman and two architects, the present award was afterwards made, in which certain facts were found, which fully bore out the above answer of the defendant to the action, and damages were assessed contingently upon the opinion of this Court as to the sufficiency of that answer in point of law. The learned gentleman now at great length urged upon the Court the hardship of attaching the penalty for the architect's defective plan upon the shoulders of the builder, who, *ex confesso*, had honestly and fairly performed his duty. If the plan were of a character which militated against the laws of matter, and was such as to insure its own defeat, it was the fault of the engineer, and not of the builder, whose contract could only be held to extend to a covenant to make good those casual defects which might be caused by wear and tear, or by the insufficiency of his own work. The defendant, therefore, submitted that he was entitled to the verdict on these facts; but at all events he trusted that the award might be set aside, and an opportunity given to him to go down to trial with certain pleas averring those facts on which he relied, in order that the solemn decision of the court of error might be obtained on the case.

The Court, however, without much hesitation, unanimously refused the rule. The law of the case was too clear to admit of a doubt. The defendant bound himself to keep a bridge in repair for a period within which it fell down. *Primâ facie* he was bound to rebuild it, and the only question was whether that construction could be varied by the context of the contract. The language, however, did not appear on examination to admit of such a solution. The defendant had the plan before him, and and the specification too, and though it was probable that he confided in the skill of the engineer, and never for a moment contemplated the possibility of the bridge falling down through the defective nature of the plan, yet if he meant to guard against such a state of things, he ought to have done so expressly. It might be a hard case; but the law was so, and the defendant was bound to make good the bridge. With regard to the second branch of the application, it was enough to say that it could never be listened to except in cases of doubt. Here there was no doubt whatever on the bench as to the liability of the defendant, and it would be idle to allow further litigation with such a view of the case on the mind of the Court. For these reasons, therefore, there must be no rule.

Rule refused.

MISCELLANEA.

NEW HOUSES OF PARLIAMENT.—Mr. Barry, Mr. De la Beche, and Mr. Charles H. Smith, the three Commissioners who were appointed by the Crown in 1839, to examine and report upon the quarries of this kingdom, and to select a proper stone suitable for the New Houses, which report is to be found in our journal, vol. 2, 1839, have received instructions to make another inspection of the quarries of Great Britain, both of stone and British marble, and to report upon the qualities of the stone already used in the New Houses, and as to the sufficiency of supply for the remainder of the building, or if there be any other stone more suitable than that now used, either for the exterior or the interior. We anticipate much valuable information in this report, which if only equal to the first, will be received with high approbation by the profession—the three Commissioners have already started on their tour of inspection.

IRON FRIGATES FOR THE NAVY.—We are glad to announce that Government have given orders for the immediate construction of two iron steam frigates, one of 900 tons to be built by Messrs. Ditchburn and Mare, of Blackwall, and furnished with engines by Messrs. Maudslays and Field, and the other vessel, of 1300 tons, to be built by Mr. Laird of Liverpool, and furnished with engines by Messrs. Fawcet and Co,

STEAM NAVIGATION IN FRANCE.—A letter from Brest states that the five steam frigates which are intended for the trans-atlantic navigation between France and the United States, are ready for sea, and will commence service in the spring; and that the French West India Steam Company are going to have a regular line of packet ships between Havre and the Brazils, besides touching at all the West India Islands. The first packets will commence running in May next.

THE WEST INDIA MAIL COMPANY'S STEAMER "THE SEVERN."—This vessel is reported to have made a trial trip at Bristol, from King's-road to Ilfracombe, and it is stated she steamed at the rate of 9 to 10 knots an hour.

THE RED ROVER.—This fine steam vessel which runs between London, Herne Bay and Margate, has undergone a thorough examination, and considerable increase of speed has been obtained; the engines are by Messrs. Boulton, Watt, and Co. This vessel has always proved to be of the first character.

NORWICH AND LEAMINGTON RAILWAY.—This branch of the Birmingham Railway is about to be commenced and pushed with vigour during the ensuing summer.

THE THAMES TUNNEL.—In the first month after the opening, 450,000 passengers have passed through.

BRISTOL AND EXETER RAILWAY.—This line will be opened to the public in a few days, to Beam's Bridge, two miles to the South of Wellington.

VALUE OF MANURE IN LARGE TOWNS.—A new contract has recently been signed, by which the contractor agrees to give £22,000 per annum for the contents of the cess-pools of the city of Paris, which are at present deposited in a place in the suburbs, called Monfaucon, but are about to be conveyed by a new drain five miles further from the city.

Sir John Guest and Co. have contracted with the Russian government for 45,000 tons of railway iron, and it is not improbable that this order will be doubled, TURKEY.—Messrs. William Fairbairn and Co. have furnished designs for a large building, to be erected for the Grand Sultan in Turkey, for the purposes of a woollen mill, dye-works, &c. It is to be built of iron and wood.

A NEW KIND OF GAS.—The *Censeur*, of Lyons, states that, at one of the late sittings of the municipal council, a trial was made of a new portable gas, to which its inventor has given the name of "hydroluminous." The apparatus, says this journal, is very simple, and applicable to the smallest candlesticks, as well as to the largest and most splendid candelabra. The light it gives is very fine, and it is so portable that it can be carried about with the common hand candlestick. Nothing is said of the comparative cost of this new light.

THE IRON COLONNADE AT MANCHESTER intended to carry the Liverpool and Leeds Junction Railway over the valley at Hunt's Bank, Manchester, is 738 feet in length and 24 feet wide, supported on 52 cast-iron columns, each weighing four tons, carrying 46 main girders, averaging $6\frac{1}{2}$ tons each; on these rest the longditudinal girders 86 in number, varying from $3\frac{1}{4}$ to $5\frac{1}{4}$ tons each, eighteen feet above the level of the street below. The whole will be fenced off on the side next the prison by a cast-iron screen, eleven feet high, the top of which will be seven feet above the rails. The style adopted, and which is in accordance with the massiveness required, is a modification of the Egyptian. The columns, with the mushroom-formed head, from which springs the favourite reeded capital of Egyptian architecture, stand upon stone basements, which project about one foot above the pavement, and give firmness and solidity to the whole appearance. The quantity of iron in the whole structure will be about 1,020 tons.

BRADFORD WATER WORKS were let to Messrs. Brook and Hardy, for the sum of nearly £6,500.

A very rich vein of lead ore has been discovered at the Shropshire Bog Mines on the property of Henry Lyster Esq.

The grand staircase now building at Devonshire-house will be entirely composed of Italian marble. The estimated expense is £10,000.

AN ENORMOUS PUMPING ENGINE.—A steam engine is now in course of construction at the celebrated Hayle foundry in Cornwall, for the Government of Holland, to drain the Lake of Haerlem, which is of far larger dimensions than any yet built. We have seen a sketch of the engine, which consists of a double cylinder, one within the other, the external cylinder is to be 144 inches in diameter and 12 feet high, and to have an annular piston with 4 piston rods; in the centre is a smaller cylinder of the same height 84 inches diameter, with a piston rod 13 inches diameter; in this last cylinder the steam is to be first admitted under the piston at a high pressure, and then allowed to escape into the external or larger cylinder, and act upon the upper surface of the piston, the five piston rods support an immense cast-iron cap said to be weighted to equal to 18 tons. The steam cylinders stand in the centre of eleven pumps, each pump is 63 inches diameter, 12 feet 6 inches long, and 10 feet stroke; the present pump rods are suspended to the ends of cast-iron beams 32 feet long placed radially to the centre of the steam cylinders, and the other end of these beams come in contact with the under edge of the steam cylinder cap, so that as the cap descends it depresses one end of the beams and raises the other end, and with it the pistons of the pumps. The weight of water lifted will be equal to 83 tons per stroke, if all the pumps were in work at one time.

LIST OF NEW PATENTS.

(From Messrs. Robertson's List.)

GRANTED IN ENGLAND FROM MARCH 25, TO APRIL 27, 1843.

Six Months allowed for Enrolment, unless otherwise expressed.

Nicholas Henri Jean Francois, Comte de Crony, of the Edgware-road, Middlesex, for "*improvements in rotary pumps and rotary steam engines.*"—Sealed March 25.

Robert Faraday, of Wardour-street, Soho, gas fitter, for "*improvements in ventilating gas burners, and burners for consuming oil, tallow, or other matters.*" (A communication.)—March 25.

Sir Samuel Brown, knight, of Blackheath, commander in Her Majesty's navy, for "*improvements in the construction of breakwaters, and in constructing and erecting lighthouses and beacons, fixed and floating, and in apparatus connected therewith, and also in anchors for mooring the same, which are applicable to ships or vessels.*"—March 27.

John Sylvester, of Great Russell-street, Middlesex, engineer, for "*improvements in producing ornamental surfaces on or with iron, applicable in the manufacture of stoves and other uses, and for improvements in modifying the transmission of heat.*'—March 28.

Arthur Dunn, of Rotherhithe, soap boiler, for "*improvements in treating, purifying, and bleaching fatty matters.*"—March 28.

James Fletcher, foreman at the works of Messrs. W. Collier and Co., engineers, for "*improvements in machinery or apparatus for spinning cotton and other fibrous substances.*"—March 30.

Frank Hills, of Deptford, manufacturing chemist, for "*improvements in steam boilers or generators, and in locomotive carriages.*

Paul Provost Brouillet, of Hadley, Middlesex, gentleman, for "*improvements in apparatus for warming apartments.*"—March 30.

John Aston, of Birmingham, and William Elliott, of the same place, button manufacturers, for "*improvements in the manufacture of covered buttons.*"—April 4.

Joseph Browne Wilkes, of Chesterfield Park, Essex, Esq., for "*improvements in treating oils obtained from certain vegetable matters.*"—April 4.

George Johnston Young, of Bostock-street, Old Gravel-lane, Wapping, engineer, for "*improvements in the construction of capstans.*"—April 5.

Edwin Whele, of Walsall, Stafford, for "*an improvement or improvements in machinery for preparing wicks used in the making of candles.*"—April 6.

James Boydell, junior, of Oak Farm iron works, near Dudley, iron-master, for "*improvements in manufacturing bars of iron with other metals.*"—April 7.

Robert Hawthorne and William Hawthorne, of the town of Newcastle-on-Tyne, civil engineers, for "*improvements in locomotive engines, parts of which arr applicable to other steam engines.*"—April 7.

John Michell, of Calenick, Cornwall, for "*improvements in extracting copper, iron, lead, bismuth, and other metals or minerals from tin ore.*"—April 11.

James Napier, of Hoxton, Middlesex, dyer, for "*improvements in preparing or treating fabrics made of fibrous materials, for covering roofs and the bottoms of ships and vessels, and other surfaces; and for other uses.*"—April 11.

Moses Poole, of Lincoln's-inn, gentleman, for "*improvements in the manufacture of ornamented lace or net.* (A communication.)—April 11.

Uriah Clarke, of Leicester, dyer, for "*improvements in the manufacture of narrow elastic and non-elastic fabrics of fibrous materials.*"—April 11.

William Tindall, of Cornhill, ship owner, for "*improvements in the manufacture of candles.*"—April 11.

William Runwell, of Bowling-green-row, Woolwich, artist, for "*improvements in machinery or apparatus for registering or indicating the number of persons which enter any description of carriage, house, room, chamber, or place, and also the number of passengers and carriages that pass along a bridge, road, or way.*"—April 13.

William Henry Smith, of Fitzroy-square, civil engineer, for "*improvements in the construction and manufacture of gloves, mitts, and cuffs, and in fastenings for the same, which may be applied to articles of dress generally.*"—April 19.

Charles Tayleur, and James Frederick Dupré, of the Vulcan Foundry, Lancaster, engineers, and Henry Dubs, also of the Vulcan Foundry, engineer, for "*improvements in boilers.*"—April 19.

James Byrom, of Liverpool, engineer, for "*an improved system of connexion for working the cranks of what are commonly called direct action steam engines.*"—April 19.

Carl Ludewick Farwig, of Henrietta-street, Covent-garden, tin-plate worker, for "*improvements in gas meters.*"—April 19.

John George Bodmer, of Manchester, engineer, for "*improvements in locomotive steam engines and carriages to be used upon railways, in marine engines and vessels, and in the apparatus for propelling the same, and also in stationary engines, and in apparatus to be connected therewith for pumping water, raising bodies, and for blowing or exhausting air.*"—April 20.

John Rand, of Howland-street, Fitzroy-square, artist, for "*improvements in the manufacture of tin and other soft metal tubes.*"—April 20.

Edward Cobbold, of Melford, Suffolk, master of arts, clerk, for "*improvements in the means of supporting, sustaining, and propelling human and other bodies on and in the water.*"—April 20.

Thomas Oram, of Lewisham, Kent, patent fuel manufacturer, and Ferdinand Charles Warlich, of Cecil-street, gentleman, for "*improvements in the manufacture of fuel, and in machinery for manufacturing fuel.*"—April 20.

James Johnston, of Willow-park, Greenock, esquire, for "*improvements in the construction of steam boilers, and machinery for propelling vessels.*"—April 20.

Richard Prosser, of Birmingham, civil engineer, and Job Cutler, of the same place, civil engineer, for "*improvements in the machinery to be used in manufacturing of pipes and bars, and in the application of such pipes or bars to various purposes.*"—April 20.

John M'Tunes, of Liverpool, manufacturing chemist, for "*improvements in funnels, for conducting liquids into vessels.*"—April 20.

Francois Constant Magloire Viollette, of Leicester Square, Middlesex, late advocate, for "*improvements for warming the interior of railroad, and other carriages.*" (A communication.)—April 22.

Richard Greville Pigot, of Old Cavendish-street, gentleman, for "*improved apparatus for supporting the human body when immersed in water, for the purpose of preventing drowning.*"—April 25.

James Moon, of Milman-street, Bedford-row, surveyor, for "*improvements in the manufacture of bricks to be used in the construction of chimneys and flues.*"—April 25.

William Brockendon, of Devonshire-street, Queen's-square, Middlesex, gentleman, for "*improvements in the manufacture of wadding for fire arms.*"—April 25.

William Mayo, of Lower Clapton, Middlesex, and John Warmington, of Wandsworth-road, Surrey, gentlemen, for "*improvements in the manufacture of aërated liquors, and in vessels used for containing aërated liquors.*" (A communication.)—April 25.

Charles Forster Cotterill, of Walsall, Stafford, merchant, for "*improvements in the progressive manufacture of grain into flour or meal, the whole or part or parts of which improvements may be applied to the ordinary method of manufacture.*"—April 27.

John Winspear, of Liverpool, ship-smith, for "*an improved mode of reefing certain sails of ships, and other vessels.*"—April 27.